

REVISIONARY NOTES ON THE SUBFAMILY GNAPTODONTINAE, WITH DESCRIPTION OF ELEVEN NEW SPECIES (HYMENOPTERA, BRACONIDAE)

by

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ABSTRACT

The tribe Gnaptogastrini Tobias, 1976, is synonymized with the tribe Gnaptodontini Fischer, 1970, and the group is given subfamily rank. The genera *Gnaptogaster* Tobias, 1976, and *Gnaptodon* Haliday, 1837, are redescribed and illustrated. A neotype for *Bracon pumilio* Nees, 1834, (type-species of *Gnaptodon*) is selected, described and illustrated. A lectotype is designated for *Diraphus pygmaeus* Wesmael, 1838. Keys are given to the Palearctic and Afrotropical species of *Gnaptodon*, of which eight new Palearctic and two new Afrotropical species are described; additionally the first Oriental *Gnaptodon* species is described. *Mesotages* Foerster, 1862, is synonymized with *Gnaptodon* Haliday, 1837, and *Mesotages decoris* Foerster, 1862, is a new senior synonym of *G. bachmaieri* Fischer, 1957, and of *G. klemensiewiczii* (Niezabitowski, 1910). The ecology of the reared Palearctic *Gnaptodon* species and the phylogenetic relationships of the Gnaptodontinae are discussed.

INTRODUCTION

The genus *Gnaptodon* contains some of the smallest Braconidae, usually scarcely longer than 1 mm and exclusively parasites of the mining caterpillars of Nepticulidae (Lepidoptera). *Gnaptodon* and its relatives are recognizable by the peculiar basal elevation of the 2nd tergite (figs. 8, 31). However, in a new species described in this paper both the elevation and the 2nd suture of the metasoma are absent (fig. 19). Owing to a fine collection of parasites of Nepticulidae assembled by Dr. G. Bryan and Mr. E. J. van Nieuwerkerken (Vrije Universiteit, Amsterdam) and the *Gnaptodon* species reared by Dr. J. Szöcs (Budapest) it has been possible to revise the Palearctic species of *Gnaptodon*. The *breviradialis* group (only described species: *breviradialis*) could be sorted out, resulting in six new species.

Tobias (1979: 240) on the basis of his material (which was not available for this study) concluded that all described Palearctic forms actually belong to one large polymorphic species with enormous variation: *G. pumilio* (Nees). I agree with Tobias that the degree of sculpture and the colour alone are inadequate and often very variable character-states. However, the wing venation, the setosity, the shape of the grooves of the metasoma and (to some extent) coloration appear to allow of the recognition of

several species, and a study of the available reared series has confirmed the usefulness of these characters.

Additionally the opportunity is taken to synonymize the tribe Gnaptogastrini Tobias, 1976, with the Gnaptodontinae, to redescribe the genus *Gnaptogaster* Tobias, 1976, and to describe two new species of *Gnaptodon* from Africa (S. Africa and Somalia) and one new species from Thailand. In the cosmopolitan genus *Gnaptodon* 21 valid species have been described and in this paper 11 species are added. The generic combinations of the host species mentioned in this paper are on behalf of Mr. E. J. van Nieuwerkerken (Amsterdam), who is currently studying the biosystematics of the Nepticulidae. If the genus is given in inverted commas then the generic placement is uncertain. For the terminology used in this paper, see Van Achterberg (1979: 242—246, figs. 1—8).

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Subfamily GNAPTODONTINAE Fischer stat. nov.

Gnaptodonina Fischer, 1970: 85, 87.

Gnaptodontini Fischer, 1972: 55—57.

Gnaptogastrini Tobias, 1976a: 319. **Syn. nov.**

Diagnosis. — Length of fore wing 1.2—1.9 mm.; antennal segments 14—26; maxillary palp with 5 or 6 segments; labial palp with 3 segments; scapus truncate apically, stout (figs. 10, 22); hypostomal, occipital, and prepectal carinae usually absent, but occipital carina present in *Liparophleps* Enderlein and *Gnaptodon novobritannicus* Fischer, and prepectal carina present in *Liparophleps*; eyes glabrous, slightly or not emarginate; antennal sockets closer to eyes than to each other (fig. 32); anterior tentorial pits rather small and deep; clypeus (largely) smooth, rather convex; apical margin of clypeus slightly concave (fig. 14); hypoclypeal depression present, transverse, but labrum (nearly) flat and glabrous; malar suture absent; length of malar space 1.0—1.5 times basal width of mandible; mandible slender, twisted apically and 1st tooth much longer than 2nd; pronope, antescutal depression, lateral carina of mesoscutum, precoxal sulcus (except for a medial pit as in *Gnaptogaster*, fig. 1) absent; posterior flange of propleuron virtually absent; notauli reduced posteriorly (figs. 9, 18); episternal scrobe narrow (fig. 10); metapleural flange small or absent; scutellum completely smooth; metanotum at most with a short antero-medial carina, posteriorly smooth and rather convex, not distinctly protruding (fig. 22); propodeum smooth, without any areolation or carinae; propodeal spiracle round, rather small and in front of middle of propodeum; propodeal tubercle absent; 1st discal cell of fore wing petiolate; vein M + CU1 of fore wing completely sclerotized; vein cu-a of both wings present, short (figs. 3, 24); veins CU1b and 2-1A of fore wing more or less reduced, resulting in a partly open 1st subdiscal cell (figs. 3, 24); parastigma small (fig. 13) or medium-sized (fig. 3); vein m-cu of fore wing antefurcal and parallel to vein 1-M; veins 2A and 2-R1 of fore wing absent; vein SR of hind wing largely absent apically (figs. 3, 24); vein M + CU of hind wing shorter than vein 1-M; length of vein 3-SR of fore wing 0.2—0.7 times vein 2-SR; tarsal claws slender apically,

simple, without lobe or pectination (fig. 2); spurs of hind tibia subequal, their length 0.2—0.3 times the basitarsus; fore tibia without spines or pegs; 1st metasomal tergite sessile, rather flat medio-basally (at least in the Oriental and Palaearctic species); spiracles of 1st tergite submedial or behind middle (figs. 1, 8, 19, 31); laterope absent (fig. 1) or small and pit-shaped (fig. 22); 2nd tergite with a curved basal elevation (figs. 8, 31), except in *Gnaptodon apheles* spec. nov. (fig. 19) which has only weak lateral traces; 2nd intersegmental suture of metasoma distinctly impressed, except in *G. apheles* spec. nov. (fig. 19); spiracles situated in notum of 2nd and 3rd metasomal tergites; metasoma depressed; ovipositor almost straight (fig. 1, 22); length of ovipositor sheath in Palaearctic and Oriental species 0.03—0.12 times fore wing.

Contains 4 genera: *Gnaptodon* Haliday, 1837 (cosmopolitan), *Pseudognaptodon* Fischer, 1965 (New World, possibly only a subgenus of *Gnaptodon*), *Gnaptogaster* Tobias, 1976 (Palaearctic), and (provisionally included) *Liparophleps* Enderlein, 1920 (Neotropical).

KEY TO GENERA OF THE SUBFAMILY
GNAPTODONTINAE

1. Occipital and prepectal carinae present
Liparophleps Enderlein (Synonym of *Plesademon* Fischer, 1961; may belong to the Doryctinae, but lacks the characteristic pegs of the fore tibia).
- Occipital and prepectal carinae absent, at most with a faint trace of the occipital carina present 2
2. Vein r-m of fore wing absent
..... *Pseudognaptodon* Fischer
- Vein r-m of fore wing present (as an unsclerotized, slightly pigmented vein, figs. 3, 13) 3
3. Dorsal carinae of 1st tergite absent (fig. 8); mesoscutal pit present (fig. 9); apex of antenna without short spine (fig. 4); pleural sulcus crenulate (fig. 1); maxillary palp with 5 segments *Gnaptogaster* Tobias
- Dorsal carinae of 1st tergite present (figs. 19, 31); mesoscutal pit absent (fig. 18); apex of antenna with short spine (fig. 11); pleural sulcus smooth (fig. 10); maxillary palp with 6 segments (fig. 16) . . . *Gnaptodon* Haliday

Genus *Gnaptogaster* Tobias, 1976

Gnaptogaster Tobias, 1976a: 319.

Type-species: *Gnaptogaster mongolica* Tobias, 1976. Gender: feminine.

Diagnosis. — Length of fore wing ca. 1.8 mm, length of body ca. 2.1 mm; antennal segments 18—20; apex of antenna without spine apically (fig. 4); maxillary palp with 5 segments; occipital carina completely absent; marginal cell of fore wing very narrow (fig. 3); apical margin of clypeus not differentiated from clypeus (fig. 6); mesopleuron smooth, except for the medial pit (fig. 1); mesoscutal pit present (fig. 9); notauli shallow, finely crenulate, but posteriorly absent (fig. 9); pleural sulcus crenulate (fig. 1); dorsal carinae of 1st metasomal tergite absent (fig. 8); basal elevation of 2nd tergite distinctly differentiated by the curved groove (fig. 8); length of ovipositor sheath ca. 0.06 times fore wing.

Contains only the East Palaearctic type-species.

***Gnaptogaster mongolica* Tobias, 1976**
(figs. 1—9)

Gnaptogaster mongolica Tobias, 1976a: 319—321, figs. 2—5.

Paratype, ♀, length of body 2.1 mm, of fore wing 1.8 mm.

Head. — Antennal segments 19, 3rd segment 1.2 times 4th segment, length of 3rd and 4th segment 2.3 and 2.0 times their width, respectively, penultimate segment 2.1 times its width; length of maxillary palp 0.5 times height of head; length of eye 2.6 times temple in dorsal view; POL: Ø ocellus: OOL = 10 : 5 : 8; frons concave behind antennal sockets, smooth; vertex rather flat and finely granulate near stemmaticum; face convex and smooth; epistomal suture present, but medially shallow (fig. 6); length of malar space equal to basal width of mandible.

Mesosoma. — Length of mesosoma 1.3 times its height; side of pronotum smooth, except for a narrow crenulate area posteriorly (fig. 1); metapleuron smooth; middle lobe of mesoscutum with weak medial suture (fig. 8); mesoscutum smooth; scutellar sulcus medium-sized, rather shallow, with 4 weak longitudinal carinae; scutellum rather convex, smooth; surface of propodeum smooth; medial carina absent.

Wings. — Fore wing: $r : 3\text{-SR} : \text{SR1} = 4 : 5 : 34$; $1\text{-CU1} : 2\text{-CU1} = 5 : 23$; $2\text{-SR} : 3\text{-SR} : r\text{-m} = 17 : 5 : 14$; m-cu far antefurcal (fig. 3). Hind wing: m-cu present as a weak, unpigmented trace (fig. 3).

Legs. — Length of femur, tibia, and basitar-

sus of hind leg 3.3, 6.1 and 6.0 times their width, respectively (fig. 5).

Metasoma. — Length of 1st tergite 0.6 times its apical width, its surface smooth, basally rather flat, medially convex, and laterally rather flattened (fig. 8); spiracles of 1st tergite after middle of tergite and not protruding (fig. 8); glymma completely absent; 2nd tergite smooth and 2nd intersegmental suture deep and smooth; all metasomal setae widely spaced, scattered; 2nd and 3rd segments with a sharp lateral crease; length of ovipositor sheath 0.06 times fore wing.

Colour. — Black; legs (but hind coxa blackish basally and hind tarsus somewhat infuscated), tegulae, palpi, mandibles, scapus and anellus mainly, and metasoma (but apically infuscated), yellowish-brown; pterostigma dark brown, wing membrane hyaline.

Holotype and paratypes in the Zoological Institute, Leningrad. The figured and redescribed paratype is topotypic with the holotype: "Mongolia, South Gobijskij ajmak, 20 km. West of well of Barin-Bugatyn-Khuduk, Kerzhner, 25—27.vii.1969" (translated), "Paratypus *Gnamptogaster* (sic!) *mongolica* Tobias".

Note. — Tobias erected a separate tribe for his *Gnaptogaster*, but this is evidently unnecessary. It fits well into the Gnaptodontinae because it shares several synapomorphous character-states with *Gnaptodon*. For example, the curved basal elevation of the 2nd tergite, the short 2nd submarginal cell of the fore wing, the absence of vein CU1b of the fore wing, the 3-segmented labial palp, the narrow and shallow hypoclypeal depression, and the (nearly) flat and glabrous labrum.

Genus *Gnaptodon* Haliday, 1837

Gnaptodon Haliday, 1837: 220. Fischer, 1972: 569. Shenefelt, 1975: 1123. Tobias, 1976a: 315—318; 1976b: 22, 47. Marsh, 1979: 173.

Diraphus Wesmael, 1838: 89. Fischer, 1972: 569. Shenefelt, 1975: 1123. Marsh, 1979: 173.

Mesotages Foerster, 1862: 258. Syn. nov.

Type-species: *Bracon pumilio* Nees, 1834. Gender: masculine.

Diagnosis. — Length of fore wing and of body, both 1.0—1.9 mm; antennal segments 14—26; apex of antenna with short spine (fig. 11); maxillary palp with 6 segments (fig. 28); apical margin of clypeus narrowly differentiated from clypeus (fig. 14); mesopleuron completely

smooth, exceptionally precoxal sulcus superficially impressed; mesoscutal pit absent (fig. 18), exceptionally with a shallow impression; pleural sulcus smooth (fig. 10); notauli of Palaearctic and Oriental species smooth, and posteriorly (nearly) absent (figs. 18, 26); dorsal carinae of 1st tergite basally present (figs. 19, 31); length of ovipositor sheath of Palaearctic and Oriental species 0.03—0.12 times length of fore wing.

Biology. — The larvae are obligatory parasites of (mining) larvae of Nepticulidae (Lepidoptera). Pupation takes place in the host cocoon, but endoparasitism remains to be proven (see chapter on phylogenetic relationships).

Distribution: Palaearctic: 12 species; Nearctic: 7 species; Neotropical: 1 species; Afrotropical: 3 species; Oriental: 1 species; Australian: 8 species.

A. PALAEARCTIC REGION

KEY TO THE PALAEARCTIC SPECIES OF THE GENUS *GNAPTODON* HALIDAY

1. Second intersegmental suture of metasoma deep medially (figs. 31, 43, 51); transverse elevation of 2nd tergite distinct medially (figs. 31, 63), exceptionally obsolete (fig. 102); colour of 3rd antennal segment variable, if dark brown, then hind femur yellowish 2
- Second suture (almost) absent (fig. 19); transverse elevation of 2nd tergite absent medially (fig. 19); 3rd antennal segment dark brown; hind femur largely dark brown *apheles* spec. nov.
2. Distance between wing apex and apex of marginal cell 1.5—3.6 times vein 1-R1 (figs. 57, 65, 74, 91); length of pterostigma 1.5—3.0 times vein 1-R1; intermediate specimens have posterior margin of elevation of 2nd tergite weakly curved or straight medially (figs. 63, 80) and metasoma of ♀ comparatively robust (fig. 110) 3
- Distance between wing apex and apex of marginal cell 0.2—1.4 times vein 1-R1 (figs. 20, 24), exceptionally up to 1.8 times (fig. 46); length of pterostigma 0.7—1.9 times vein 1-R1; intermediate specimens have posterior margin of elevation of 2nd tergite distinctly curved (figs. 51, 53) and metasoma of ♀ comparatively slender (fig. 53) .. 9
3. Vein r of fore wing about as long as vein 3-SR or longer (fig. 91); antero-lateral grooves of 3rd tergite rather deep (excep-

tionally obsolete) and (very) finely crenulate (fig. 92); vertex (largely) smooth; antennal segments 17—19

- *breviradialis* Fischer
- Vein r of fore wing shorter than vein 3-SR (fig. 74, 84); antero-lateral grooves of 3rd tergite absent or shallow and smooth (figs. 72, 80); vertex often coriaceous; antennal segments 18—23 4
 - 4. Marginal cell of fore wing narrow (fig. 57); distance between wing apex and apex of marginal cell about 3 times vein 1-R1 (fig. 57); metasoma completely yellowish; length of vein SR1 of fore wing about 3 times vein 3-SR (fig. 57); episternal scrobe deep (fig. 55); ocelli small, POL 2.5—3 times diameter of posterior ocellus (fig. 56); medial length of 2nd tergite about 1.5 times medial length of 3rd tergite (fig. 63) *brevis* spec. nov.
 - Marginal cell of fore wing wider (figs. 65, 96); distance between wing apex and apex of marginal cell 1.5—2.2 times vein 1-R1; colour of metasoma variable; length of vein SR1 of fore wing 4.0—6.7 times vein 3-SR (figs. 74, 96); episternal scrobe rather shallow or obsolete (fig. 94); ocelli larger, POL about twice diameter of posterior ocellus or shorter (figs. 93, 98); medial length of 2nd tergite less than 1.5 times medial length of 3rd tergite (figs. 80, 85) 5
 - 5. Vertex almost completely smooth and strongly shiny (fig. 71); 3rd tergite with shallow and smooth antero-lateral grooves (fig. 72); 1st and 2nd tergites, antero-lateral corners and hind tarsi (except telotarsus), ivory-whitish; 2nd suture of metasoma distinctly crenulate medially (fig. 72); vein SR1 of fore wing straight (fig. 65) *vlugi* spec. nov.
 - Vertex coriaceous, moderately shiny (fig. 83); 3rd tergite with no antero-lateral grooves (figs. 80, 102), colour and vein SR1 variable; 2nd suture smooth or indistinctly crenulate (figs. 80, 102) 6
 - 6. Long dense setose between antennal sockets (figs. 76, 77); medio-longitudinal groove of mesoscutum anteriorly as deep as notauli (fig. 81); medial length of 3rd tergite equal to medial length of 2nd tergite (fig. 80) or slightly less; 2nd tergite dark brown posteriorly *pilosus* spec. nov.
 - Sparsely setose between antennal sockets (fig. 83); medio-longitudinal groove of mesoscutum anteriorly shallower than no-

- tauli (figs. 82, 100); medial length of 3rd tergite variable (figs. 85, 110); 2nd tergite frequently completely yellowish 7
7. Hind coxa at least basally and hind femur dorso-apically infuscated; 2nd tergite posteriorly and hind tarsus dark brown; medial length of 3rd tergite of ♀ 1.1—1.3 times medial length of 2nd tergite (fig. 85); marginal cell of fore wing comparatively narrow (fig. 84), distance between wing apex and apex of marginal cell 1.9—2.4 times vein 1-R1; face (except medially) densely and transversely rugulose-coriaceous *nieukerkeni* spec. nov.
- Hind coxa, hind femur apically, 2nd tergite posteriorly and hind tarsus (except telotarsus), yellowish; medial length of 3rd tergite of ♀ 0.7—0.8 times medial length of 2nd tergite (figs. 102, 110); marginal cell of fore wing somewhat wider (figs. 96, 104), distance between wing apex and apex of marginal cell 1.6—1.9 times vein 1-R1; face coriaceous or smooth 8
8. Head and apical half of metasoma yellowish; 2nd suture of metasoma rather angularly bent (fig. 102); pterostigma and 3rd and 4th antennal segments dark brown; antennal segments of ♀ about 21; scutellar sulcus distinct (fig. 100) *ruficeps* spec. nov.
- Head and apical half of metasoma black; 2nd suture of metasoma rather evenly curved (fig. 110); pterostigma light brown; 3rd and 4th antennal segments of ♀ about 18; scutellar sulcus very shallow (fig. 107) *erasmi* spec. nov.
9. Distance between wing apex and apex of marginal cell of fore wing 0.2—0.5 times vein 1-R1 (fig. 24); vein SR1 of fore wing largely straight (fig. 24); area behind transverse elevation of 2nd tergite often more or less sculptured (fig. 31) 10
- Distance between wing apex and apex of marginal cell of fore wing 0.7—1.8 times vein 1-R1 (figs. 20, 46); vein SR1 rather sinuate (fig. 46); area behind elevation of 2nd tergite often largely smooth (figs. 51, 53) 11
10. Length of vein 1-R1 of fore wing 2—4 times distance between wing apex and apex of marginal cell of fore wing (fig. 24); 3rd antennal segment yellowish, exceptionally dark brown; mainly parasite of Nepticulidae in trees *pumilio* (Nees)
- Length of vein 1-R1 of fore wing about 5 times distance between wing apex and apex of marginal cell of fore wing (fig. 96 in Fischer, 1966); 3rd antennal segment dark brown *nepalicus* Fisher
11. Four basal segments of antenna of ♀ infuscated or dark brown dorsally, exceptionally (largely) yellowish; medial length of basal elevation of 2nd tergite less than 0.6 times medial length of rest of tergite or, if longer, less narrowed laterally (cf. fig. 31); medio-longitudinal groove of mesoscutum often distinct; metasoma usually dark brown or black, if partly yellowish then elevation of 2nd tergite indistinct medially; antennal segments of ♀ mostly 21; parasites of Nepticulidae in herbs and (low) shrubs *decoris* (Foerster)
- Four basal antennal segments of ♀ yellowish; medial length of basal elevation of 2nd tergite 0.6—1.0 times medial length of rest of tergite and elevation distinctly narrowed laterally (figs. 51, 53); medio-longitudinal groove of mesoscutum usually obsolete (fig. 49); several tergites of metasoma yellowish; basal elevation of 2nd tergite distinct medially; antennal segments of ♀ usually 19 or 20; parasites of Nepticulidae in trees and (tall) shrubs *georginae* spec. nov.

Note. — Of the 7 Nearctic species, 3 are close to Palaearctic spp.: *Gnaptodon bicolor* Fischer, 1965, is near *erasmi*, but *bicolor* has length of mesosoma about 1.5 times its height and distance between apex of fore wing to apex of marginal cell about 1.5 times vein 1-R1 (fig. 876 in Fischer, 1977). *G. glaber* Fischer, 1965, is close to *georginae* but the latter has infuscated hind tarsi, pterostigma dark brown, and face less sculptured. Finally *G. nepticulae* (Rohwer, 1915) (= *G. pulchrigaster* Fischer, 1965, according to Marsh, 1974) is close to *pumilio*, but *nepticulae* differs by the reddish base of the metasoma and the deep, crenulate, anterolateral grooves of 3rd tergite. The only Neotropical species described, *G. novoteutonicus* Fischer, 1977, is exceptional because of its long ovipositor.

***Gnaptodon apheles* spec. nov.**
(figs. 10—19)

Holotype, ♀, length of body and of fore wing both 1.6 mm.

Head. — Antennal segments 20, length of 3rd segment 1.2 times 4th segment, length of 3rd and 4th segments 3.5 and 2.8 times their width

respectively, penultimate segment 1.7 times its width; length of maxillary palp 0.9 times height of head; length of eye 1.5 times temple in dorsal view; POL : Ø ocellus : OOL = 8 : 4 : 10; frons slightly convex, smooth; vertex convex, faintly coriaceous; face laterally coriaceous, shiny; length of malar space 1.5 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.5 times its height; middle lobe of mesoscutum slightly impressed (fig. 18); scutellar sulcus rather narrow and shallow, and with one medial longitudinal carina besides the crenulae (fig. 18); episternal scrobe medium-sized (fig. 10).

Wings. — Fore wing: $r : 3\text{-SR} : \text{SR1} = 6 : 11 : 62$; $1\text{-CU1} : 2\text{-CU1} = 1 : 9$; $2\text{-SR} : 3\text{-SR} : r\text{-m} = 16 : 11 : 11$; distance of wing apex to apex of marginal cell 0.5 times length of vein 1-R1; length of pterostigma 0.8 times length of vein 1-R1 (fig. 13); vein SR1 nearly straight (fig. 13).

Legs. — Length of femur, tibia and basitarsus of hind leg 4.4, 8.5, and 7.5 times their width, respectively.

Metasoma. — Length of 1st tergite equal to its apical width, its surface smooth, and dorsal carinae weakly developed in front of spiracles (fig. 19); 2nd tergite smooth, without distinct transverse elevation basally, except for some lateral traces (fig. 19); 2nd intersegmental suture absent; length of ovipositor sheath 0.06 times fore wing.

Colour. — Black; antenna, palpi, coxae, trochanters, middle and hind femora, tegulae, pterostigma, wing veins, and metasoma ventrally, dark brown; rest of legs yellowish brown; wing membrane hyaline.

Holotype in the Haeselbarth Collection, München: "St. Peter/Ahrntal, Südtirol, 1900 m, J/26.8.(19)67, Haeselbarth". Paratype: 1 ♀ (Rijksmuseum van Natuurlijke Historie, Leiden), topotypic, but from 2200 m. Antennal segments 20, length of fore wing 1.7 mm; length of ovipositor sheath 0.06 times fore wing; length of body 1.5 mm; other characters essentially as holotype.

Note. — The wing venation of *G. apheles* is similar to the venation of *G. pumilio* (Nees), but *pumilio* differs (in addition to its sculptured 1st tergite, the distinct transverse groove of its 2nd tergite, and the deep 2nd suture of its metasoma) by its yellowish scapus, pedicellus, 3rd antennal segment, and its more extensive yellowish legs.

Gnaptodon breviradialis Fischer

(figs. 91—93)

Gnaptodon breviradialis Fischer, 1959: 259; 1972: 571—572, fig. 435. Shenefelt, 1975: 1123. Tobias, 1976b: 48. Szócs, 1979: 200, 201.

Variation. — Antennal segments 17—19; length of fore wing and of body, both 1.4—1.8 mm; 4 or 5 basal antennal segments yellowish; vein r of fore wing about as long as vein 3-SR of longer (fig. 91); length of pterostigma 1.6—3 times vein 1-R1 of fore wing; distance between wing apex and apex of marginal cell of fore wing 2.1—3.6 times vein 1-R1; 3rd tergite with usually finely crenulate antero-lateral grooves, but these sometimes shallow and smooth; vertex smooth.

Specimens examined: Holotype, ♀, also 7 ♀ and 7 ♂. The examined specimens originate from France, Hungary and Greece.

Hosts. — Nepticulidae in the tree zone:

in *Loranthus europaeus* Jacq. (in Greece collected from *Castanea* trees):

ex *Nieplertia loranthella* (Klimesch); Greece, Evvoia, Dhírfis Oros, 2 km NE Steni, 500 m, *Castanea-Abies* forest; id., S slopes of Dhírfis Oros, 700—900 m; Hungary, Normafa.

in *Ulmus* spec.:

ex *Stigmella ulmivora* (Fologne); France, Digne.

in *Prunus mahaleb* L.:

ex *Ectoedemia mahalebella* (Klimesch); Greece, Mt. Timfristos, Evritania, above Karpenission, *Spartium* shrub, 1200—1400 m.

in *P. cocomilia* Ten.:

ex *Stigmella amygdali* (Klimesch); Greece, 4 km NW Timfristós, (vill.), Fthiotis, 1400 m, clearings in *Abies* wood.

Tobias (1976b: 48) reported *breviradialis* from the European part of the U.S.S.R. and gives *Stigmella prunetorum* (Stainton) as host.

Gnaptodon brevis spec. nov.

(figs. 55—63)

Holotype, ♀, length of body 1.4 mm, of fore wing 1.3 mm.

Head. — Antennal segments 20, length of 3rd segment 1.2 times 4th segment, length of 3rd and 4th segments 3.7 and 3.0 times their width, respectively, the penultimate segment 2 times its width (fig. 61); length of maxillary palp 0.8 times height of head; length of eye 1.6 times

temple in dorsal view (fig. 56); POL : \emptyset ocellus : OOL = 14 : 5 : 19; frons rather flat and coriaceous; vertex distinctly coriaceous, face medially smooth, otherwise coriaceous (fig. 62); length of malar space 1.5 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.2 times its height; medio-longitudinal depression of mesoscutum absent (fig. 60); scutellar sulcus rather shallow and medium-sized, crenulate (fig. 60); episternal scrobe deep (fig. 55).

Wings. — Fore wing : r : 3-SR : SR1 = 3 : 6 : 16; 1-CU1 : 2-CU1 = 1 : 8; 2-SR : 3-SR : r-m = 16 : 11 : 11; length of pterostigma 2.3 times vein 1-R1; distance between apex of fore wing and apex of marginal cell 3 times vein 1-R1 (fig. 57); vein SR1 straight.

Legs. — Length of femur, tibia and basitarsus of hind leg 3.1, 8.5, and 5.3 times their width, respectively.

Metasoma. — Length of 1st tergite 0.6 times its apical width, its surface superficially coriaceous (fig. 63), and dorsal carinae present in basal half of tergite; 2nd tergite behind basal elevation coriaceous, basal elevation smooth and distinctly transverse (fig. 63), its medial length 0.4 times medial length of rest of tergite; medial length of 2nd tergite 1.5 times 3rd tergite; 3rd and following tergites largely coriaceous, with no antero-lateral grooves; 2nd suture deep, curved and indistinctly crenulate; length of ovipositor sheath 0.12 times fore wing.

Colour. — Dark brown (including pterostigma and veins); antenna dark brown, but 3 basal segments ventrally yellowish; palpi, legs (but telotarsi infuscated), tegulae, and whole metasoma, yellowish; mesosoma laterally largely rather reddish; wing membrane slightly infuscated.

Holotype in Museum Budapest: "Budaörs, Törökugrato" (= Hungary), 1975.vii.16, Szöcs J., "*Filipendula vulgaris*", "ex *Nepticula hexapetalae* Szöcs".

Host: *Ectoedemia hexapetalae* (Szöcs) in *Filipendula vulgaris* Moench.

***Gnaptodon decoris* (Foerster) comb. nov.**
(fig. 20)

Mesotages decoris Foerster, 1862: 258.

Gnamptodon bachmaieri Fischer, 1957: 41. **Syn. nov.**

Gnamptodon bachmaieri; Fischer, 1972: 570—571. Shenefelt, 1975: 1123. Tobias, 1976b: 48. Szöcs, 1979: 200—201.

Gnamptodon bachmaieri (sic!); Fischer, 1980: 202.

Gnamptodon klemensiewiczii Niezabitowski, 1910: 44. Shenefelt, 1975: 1123—1124. **Syn. nov.**

Variation. — Antennal segments 20—23 (mostly 21); length of fore wing 1.2—1.7 mm, of body 1.1—1.7 mm; 5th—7th tergites of metasoma sometimes yellowish-brown, usually dark brown; length of pterostigma 1.0—1.6 (usually 1.1—1.2) times length of vein 1-R1; distance between apex of fore wing and apex of marginal cell 0.9—1.5 times vein 1-R1; 3rd antennal segment and base of metasoma dark brown, exceptionally yellowish; 2nd and 3rd tergites usually smooth, but sometimes superficially sculptured behind the transverse elevation and the 2nd metasomal suture; vertex coriaceous. Specimens examined: 22 ♀ and 29 ♂.

The examined specimens originate from Great Britain (Wales), Netherlands (Wijster, dunes of Meijendel (near the Hague) and of Oostvoorne, Kunrade (Kunderberg), and Hilversum (Spanderswoud)), West Germany, Italy, Austria, Hungary, Bulgaria and Greece.

Hosts. — Nepticulidae in herbs and (low) shrubs:

in *Lotus corniculatus* L.:

ex *Trifurcula cryptella* (Stainton); Netherlands, Kunrade, Kunderberg (2nd tergite dark brown and hind coxa infuscated).

in *Coronilla varia* L.:

from same host; Hungary, Svár.

in *Fragaria vesca* L.:

ex *Stigmella fragariella* (Heyd.) (on label, cf. *aurella* (F.)); Hungary, Budapest, Petneházirét (apex of metasoma reddish, rest of metasoma dark brown, hind coxa yellowish).

in *Sanguisorba officinalis* L.:

ex *S. geminella* (Frey) (on label, cf. *poterii* (Stainton)); Hungary, Fót, Mogyoródi p. (only 1st tergite and apex of metasoma dark brown, rest yellowish, hind coxa infuscated).

in *Rubus* spec.:

ex *S. splendidissimella* (H.-S.) or *aurella* (F.); Netherlands, Hilversum, Spanderswoud (2nd tergite yellowish).

in *Rosa pimpinellifolia* L.:

ex *S. spec.*; U.K., Wales, Pembrey, Carmarthen.

in *Agremonia agrimonoides* (L.):

ex *Ectoedemia agrimoniae* (Frey); Greece, Evvoia, Dhírfis Oros, S. slopes, *Castanea-Abies*-forest, 700—900 m (elevation of 2nd tergite largely absent, 2nd tergite and hind coxa yellowish).

in *Potentilla erecta* L.:

ex *Stigmella poterii* (Stainton); Hungary, Svár.

in *Potentilla* spec.:

ex *S. occultella* (Hein.) (on label, cf. *poterii* (Stainton)); Austria, Schörförling, north of Attersee; id., Hinter-Stoder.

in *Prunus spinosa* L.:

ex *S. plagicolella* (Stainton); Hungary, Vérteszkozma (aberrant because of yellowish 3rd and 4th antennal segments; 2nd tergite dark brown).

in *Betula nana* L.:

ex *S. betulicola nanivora* Petersen; West Germany (types of *G. bachmaieri* (Fischer), examined: 2nd tergite dark brown, hind coxa yellowish).

Notes. — The type of *Gnaptodon klemensiewiczii* Niezabitowski, 1910, was not available for study (it is part of a private collection; according to Tobias (1979: 237) the type is lost). Judging from the original description (1st and 2nd tergites smooth and 3rd antennal segment blackish) it is most likely to be a junior synonym of *G. decoris* (Foerster).

During my visits to the Berlin Museum I examined the holotype of *Mesotages decoris* Foerster, 1982. It is a completely yellowish specimen, probably owing to ageing (as many other small specimens in the Foerster collection are bleached). The length of the pterostigma is 1.5 times vein 1-R1 (metacarp) and the distance between the apex of the fore wing and the apex of the marginal cell is 1.4 times vein 1-R1. The vertex is distinctly coriaceous and the 2nd suture of the metasoma smooth. The basal elevation of the 2nd tergite is rather transverse. Foerster stated in the original description that the transverse elevation of the 2nd tergite is absent, but the surface of the 2nd tergite of the metasoma is obscured by some glue and by part of the hind wing. If looked for carefully the typical transverse elevation of the 2nd tergite can be seen. This explains how Foerster arrived at his incorrect statement in the original description and Fischer's description of this species as *bachmaieri*. The holotype of *decoris* in the Foerster Collection (Zoologisches Museum, Berlin) bears the following labels: "24/926", "Rheinprovinz", "Frst", "*decoris* Frst", "*Gnaptodon bachmaieri* Fi., det. Fischer", "Glaube nicht dass dieser Ex. die Type von *Mesotages decoris* sein kann. Foerster schreibt ausdrücklich dass *Mesotages* keine bogenförmige gekrümmten Furchen an den 2. Tergit hat, Fischer, 1963". As pointed out above, I disagree with Fischer's statement and synonymize *Gnaptodon bachmaieri* Fischer, 1957, with

Gnaptodon decoris (Foerster, 1862) comb. nov. There is a second specimen under *decoris* in the Foerster Collection, which does not belong to the type-series, and also has a reduced, easily overlooked transverse elevation on the 2nd tergite.

***Gnaptodon erasmi* spec. nov.**
(figs. 103—111)

Holotype, ♀, length of body 1.6 mm, of fore wing 1.5 mm.

Head. — Antennal segments 18, length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3.5 and 3.2 times their width, respectively, penultimate segment 1.9 times its width (fig. 105); length of maxillary palp 0.7 times height of head; length of eye twice temple in dorsal view (fig. 108); POL : Ø ocellus : OOL = 6 : 4 : 9; frons slightly convex, coriaceous; vertex completely coriaceous; face largely smooth, only laterally coriaceous, rather flat (fig. 111); length of malar space 1.7 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.4 times its height; medio-longitudinal groove of mesoscutum absent, represented only by a wide shallow depression (fig. 107); scutellar sulcus very shallow, narrowly crenulate (fig. 107); episternal scrobe rather shallow (fig. 103).

Wings. — Fore wing: r : 3-SR : SR1 = 7 : 10 : 46; 1-CU1 : 2-CU1 = 2 : 15; 2-SR : 3-SR : r-m = 11 : 5 : 8; length of pterostigma twice length of vein 1-R1; distance between wing apex and apex of marginal cell 1.9 times vein 1-R1; vein SR1 slightly curved (fig. 104).

Legs. — Length of femur, tibia and basitarsus of hind leg 3.2, 6.8 and 4.5 times their width, respectively.

Metasoma. — Length of 1st tergite 0.9 times its apical width, its surface coriaceous, and posteriorly rugulose (fig. 110); dorsal carinae distinct in basal 0.6 of 1st tergite; basal elevation of 2nd tergite distinct medio-posteriorly (fig. 110), its medial length 0.3 times rest of tergite; metasoma behind elevation of 2nd tergite largely coriaceous (fig. 103); 2nd suture deep, finely crenulate and rather evenly curved (fig. 110); medial length of 3rd tergite 0.7 times length of 2nd tergite; length of ovipositor sheath 0.07 times fore wing.

Colour. — Black; 4 basal segments of antenna (rest dark brown), palpi, tegulae and legs, brownish-yellow; 1st and 2nd tergite, and antero-lateral corners of 3rd tergite, reddish-brown; pterostigma light brown.

Holotype in Haeselbarth Collection: "Riva s. Garda (North Italy), 150 m, G/10.9.67, Haeselb."; (G = collected in vegetation of *Quercus ilex*-shrubwoodland, on lime, with very strong dominance of *Q. ilex*, mixed with *Fraxinus ornus*). Paratype, 1 ♂ (Rijksmuseum van Natuurlijke Historie, Leiden): "*Ectoedemia groschkei* (Skala) in *Vitex agnus-castus*, VU no. 80675 KE", "Ellas (Greece), Sept. 1980, S. B. J. Menken & E. J. v. Nieuwerkerken", "4 km SW Papadates (Préveza), cult. area, roadside, 100 m, 39.17N-20.46 E, 25.ix.1980, st. 53"; antennal segments 19, basal elevation of 2nd tergite obsolete medially, otherwise as holotype.

Host: "*Ectoedemia*" *groschkei* (Skala) in *Vitex agnus-castus* L.

Note. It is a pleasure to me to dedicate this species to Dr. E. Haeselbarth (München).

***Gnaptodon georginae* spec. nov.**
(figs. 44—54)

Holotype, ♂, length of body 1.5 mm, of fore wing 1.4 mm.

Head. — Antennal segments 20, length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3 and 2.7 times their width, respectively, penultimate segment 1.8 times its width (fig. 48); length of maxillary palp 0.7 times height of head; length of eye twice temple in dorsal view; POL : Ø ocellus : OOL = 7 : 5 : 10; frons flat, largely coriaceous; vertex distinctly coriaceous (fig. 52); face superficially coriaceous-pimply (fig. 45); length of malar space 1.3 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.3 times its height; medio-longitudinal groove obsolete (fig. 49); scutellar sulcus narrow, rather shallow (fig. 49); episternal scrobe indistinct (fig. 44).

Wing. — Fore wing: $r : 3-SR : SR1 = 5 : 9 : 60$; $1-CU1 : 2-CU1 = 3 : 23$; $2-SR : 3-SR : r-m = 24 : 9 : 15$; length of pterostigma 1.9 times vein 1-R1; distance between wing apex and apex of marginal cell 1.8 times vein 1-R1; vein SR1 slightly sinuate (fig. 46).

Legs. — Length of femur, tibia, and basitarsus of hind leg 3.4, 7.7 and 5 times their width, respectively.

Metasoma. — Length of 1st tergite 0.8 times its apical width, its surface smooth; dorsal carinae distinct in basal 0.7 of 1st tergite (fig. 51); basal elevation of 2nd tergite distinctly narrowed laterally, medio-posteriorly distinctly curved (fig. 51), its medial length 0.8 times rest of tergite; area directly behind elevation of 2nd

tergite, as rest of tergites basally, weakly coriaceous (fig. 44); tergites otherwise smooth; 2nd suture rather deep, smooth; 3rd tergite with no antero-lateral grooves; medial length of 3rd tergite 0.9 times length of 3rd tergite (fig. 51).

Colour. — Black; tegulae (largely), pterostigma, 1st tergite medially, and antenna, dark brown; palpi, rest of 1st tergite, 2nd and 3rd tergites, antero-lateral corners of 3rd tergite, and legs (except the infuscated apex of hind tibia and the hind tarsus), brownish-yellow.

Holotype in Rijksmuseum van Natuurlijke Historie, Leiden: "ex *Stigmella hybnerella* (Hbn.), *Crataegus monogyna*, VU no. 80061 K1" "11 km ESE of Morris O.m., 26.iv.1980, Marsh & *Pistacia carr.*", "Stat. 19", "Algeria, E. v. Nieuwerkerken, G. Bryan & P. Oosterbroek". Paratypes, 5 ♀ + 2 ♂ : 1 ♀ + 1 ♂ (Museum Budapest): "Tahi, Pilis hegys." "1973.v.28, Szöcs J.", "*Nepticula malella* Stt. det. J. Szöcs", "*Malus sylvestris*"; 2 ♀ (Shaw Collection, Edinburgh): "Sulzchopf, BL., Switz(erland), LT/96, 470 m, H: *Stigmella tityrella*, mine coll. 11.10.76, PIE 23.7.77, S.E. Whitebread"; 1 ♀ (Zaykov Collection, Plovdiv): "22.9.1968, Rodopi, Parvenez, leg. A. Germanov"; 1 ♂ (id): "21.5.1968, Plovdivsko Starosel, leg. A. Germanov"; 1 ♀ (Rijksmuseum van Natuurlijke Historie, Leiden): "Jambol, Ormana, 1981.v.27, leg. Zaykov". The latter 3 specimens are from Bulgaria.

Variation. — Antennal segments 19—21 (♀) or 20—23 (♂); 4—6 basal segments of ♀ antenna yellowish, penultimate segment twice its width (fig. 54), ♂ has basal antennal segments infuscated or blackish; length of fore wing 1.4 mm (3 specimens); length of pterostigma 1.2—1.9 times vein 1-R1; distance between apex of fore wing and apex of marginal cell 1.1—1.8 times vein 1-R1; medial length of basal elevation of 2nd tergite 0.6–1.0 times rest of tergite; 2nd tergite often completely smooth (fig. 53); 2nd and 3rd tergites usually yellowish, if dark brown then apical half of metasoma yellowish (ex *S. tityrella*); length of ovipositor sheath 0.04 times fore wing.

Hosts: *Stigmella hybnerella* (Hübner) in *Crataegus monogyna* L., *S. malella* (Stainton) in *Malus sylvestris* (L.), *S. ruficapitella* (Haworth) in *Quercus*, and *S. tityrella* (Stainton) in *Fagus sylvatica* L.

It is a great pleasure to me to dedicate this species to Dr. Georgina Bryan (Amsterdam), who made an important collection of reared parasites of Nepticulidae available for study.

Gnaptodon nepalicus Fischer

Fischer, 1966: 159—161, figs. 96—97. Shenefelt, 1975: 1124.

Fischer considered *G. nepalicus* an Oriental species; however, I prefer to include it among the Palearctic spp., because it was collected at 6800 ft. in the Himalayas. The fauna at such high altitudes is more closely correlated with the (South) Palearctic region than with the Oriental region. As shown in the foregoing key *nepalicus* is close to *G. pumilio* and seems to differ mainly in the colour of the antenna and in the wing venation.

Gnaptodon nieukerkeni spec. nov.

(figs. 82—90)

Holotype, ♀, length of body and of fore wing 1.4 mm.

Head. — Antennal segments 18 (right antenna) or 19 (left one), length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3.2 and 3.0 times their width, respectively, penultimate segment 2.2 times its width (fig. 89); length of maxillary palp 0.7 times height of head; length of eye 2.1 times temple in dorsal view (fig. 83); POL : Ø ocellus : OOL = 14 : 7 : 18; frons coriaceous, flat; vertex completely coriaceous; face rather convex and obliquely, finely rugulose-coriaceous, medially narrowly smooth (fig. 90); length of malar space 1.7 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.4 times its height; medio-longitudinal groove obsolete (fig. 87); scutellar sulcus deep, rather narrow, and distinctly crenulate (fig. 87); episternal scrobe absent.

Wings. — Fore wing: r : 3-SR : SR1 = 2 : 5 : 24; 1-CU1 : 2-CU1 = 1 : 10; 2-SR : 3-SR : r-m = 8 : 5 : 6; length of pterostigma 2.1 times vein 1-R1; distance between wing apex and apex of marginal cell 2.2 times vein 1-R1; vein SR1 slightly sinuate (fig. 84).

Legs. — Length of femur, tibia and basitarsus of hind leg 3.4, 7.3 and 5.0 times their width, respectively.

Metasoma. — Length of 1st tergite 0.8 times its apical width, its surface smooth (fig. 85); dorsal carinae present in basal third of 1st tergite; basal elevation of 2nd tergite distinct, its medial length 0.4 times medial length of rest of tergite; 2nd tergite behind elevation and rest of metasoma largely coriaceous; 2nd suture deep and smooth; 3rd tergite with no antero-lateral grooves and its medial length 1.2 times medial

length of 2nd tergite (fig. 85); length of ovipositor sheath 0.03 times fore wing.

Colour. — Black; antenna (except yellowish annellus), tegulae, pterostigma and wing veins, dark brown; palpi, and legs, yellowish (but hind coxa dorsally largely, hind femur apico-dorsally and hind tarsus (other tarsi slightly) infuscated; 2nd tergite medially and antero-laterally brown, rest of tergite dark brown.

Holotype in Rijksmuseum van Natuurlijke Historie, Leiden: "Parnassós Oros, 2 km, W. Summit (Voiotia), rocks, dwarf shrub, 38.32 N-22.35 E, 2000 m, 28.ix.1980, St. 58", "No. 80.685 KE, 21/24.x.80, in leaf-litter!", "ex *Stigmella* cf. *rhamnophila* (Amsel), *Rhamnus saxatilis*, VU no. 80.685 K.", "Ellas, Greece, September 1980, S. B. J. Menken, E. J. van Nieukerken". Paratypes: 12 ♀ and 2 ♂ from same series (Vrije Universiteit, Amsterdam; Rijksmuseum van Natuurlijke Historie, Leiden; Museum Budapest; Collectie Zaykov, Plovdiv).

Variation. — Antennal segments 17—20; length of fore wing 1.2—1.4 mm; vein SR1 of fore wing usually more curved than in fig. 84; length of pterostigma 1.8—2.3 times vein 1-R1; distance between apex of fore wing and apex of marginal cell 1.9—2.4 times vein 1-R1; medial length of 3rd tergite 1.1—1.3 (♀) or 0.9 (♂) times medial length of 2nd tergite; 2nd tergite often (rather dark) brownish medially.

Host: *Stigmella* cf. *rhamnophila* (Amsel) in *Rhamnus saxatilis* Jacq.

Gnaptodon pilosus spec. nov.

(figs. 73—81)

Holotype, ♀, length of body 1.4 mm, of fore wing 1.3 mm.

Head. — Antennal segments 21, length of 3rd segment 1.3 times 4th segment, length of 3rd and 4th segments 2.2 and 1.7 times their width, respectively, penultimate segment 1.4 times its width (fig. 75); length of maxillary palp 0.8 times height of head; length of eye 2.2 times temple in dorsal view (fig. 77); POL : Ø ocellus : OOL = 7 : 4 : 11; frons slightly concave behind antennal sockets, coriaceous; vertex distinctly coriaceous (fig. 77); face rather convex and largely smooth, only microsculptured laterally (fig. 76); long and densely setose between antennal sockets (figs. 76, 77; this setosity is absent in all other spp. treated in this paper); length of malar space 1.1 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.1 times its height; medio-longitudinal groove rather

deep, similar to notauli anteriorly (fig. 81); scutellar sulcus rather wide and deep, narrowly crenulate (fig. 81); episternal scrobe indistinct (fig. 73).

Wings. — Fore wing: $r : 3-SR : SR1 = 5 : 9 : 61$; $1-CU1 : 2-CU1 = 1 : 8$; $2-SR : 3-SR : r-m = 20 : 9 : 11$; length of pterostigma 1.8 times vein 1-R1; distance between wing apex and apex of marginal cell 1.8 times vein 1-R1; vein SR1 straight (fig. 74).

Legs. — Length of femur, tibia, and basitarsus of hind leg 3.4, 6.4 and 4 times their width, respectively.

Metasoma. — Length of 1st tergite 0.8 times its apical width, its surface aciculate in posterior half, the rest smooth (fig. 80), dorsal carinae present in basal 0.7; basal elevation of 2nd tergite distinct (somewhat cariniform at posterior edge), its medio-longitudinal length half the length of rest of 2nd tergite; metasoma behind elevation of 2nd tergite largely coriaceous (fig. 80); medio-longitudinal length of 2nd tergite equal to length of 3rd tergite; 2nd suture finely crenulate and rather deep; length of ovipositor sheath 0.08 times fore wing.

Colour. — Black; 4 basal segments of antenna (but scapus and pedicellus dark dorsally), palpi, humeral plate (tegula dark brown), legs (except dark brown tarsi), metasoma ventrally, 1st tergite (medially infuscated) and anterior half of 2nd tergite, yellowish; rest of antenna medially brown, its apical half dark brown; pronotal sides and mesopleuron with brownish stripe ventrally (absent in paratypes); apex of pterostigma whitish, rest dark brown.

Holotype in Museum Budapest: "Budapest, Rupphegy", "1974.vi.9, Szöcs J.", "*Quercus pubescens*, semen", "ex *Nepticula* sp., 1974.vii.8." Paratypes, 1 ♀ + 1 ♂: 1 ♂ (Museum Budapest): "Hungaria, Budaörs. Naphegy", "1977.v.26., Szöcs J.", "*Quercus pubescens*", "ex *Nepticula eberhardi* Joh., det. J. Szöcs". As holotype, but metasoma slender, antennal segments 23, 1st tergite smooth, and pterostigma completely dark brown; 1 ♀ (Rijksmuseum van Natuurlijke Historie, Leiden): "Fót (= Hungary), 1960.ix.19", "lg. Mihályi". Antennal segments 21; as holotype, but medial length of 2nd tergite 1.1 times 3rd tergite.

Host: *Stigmella eberhardi* (Joh.) in *Quercus pubescens* Willd.

Variation. — Antennal segments 21—23, length of fore wing 1.3—1.5 mm; length of pterostigma 1.5—2.1 times vein 1-R1; distance between apex of fore wing and apex of marginal

cell 1.6—2.1 times vein 1-R1.

Note. *G. pilosus* resembles the Nearctic *G. glaber* Fischer, 1965, but *glaber* has the pterostigma yellowish, length of mesosoma about 1.5 times its height, 1st tergite longer than apical width, metasoma completely smooth and face distinctly coriaceous.

Gnaptodon pumilio (Nees) (figs. 22—33)

Bracon pumilio Nees, 1834: 90—91.

Gnaptodon pumilio; Fischer, 1972: 572—574, figs. 436—437. Shenefelt, 1975: 1124. Tobias, 1976b: 48. Van Achterberg, 1976: 60, figs. 37, 38. Huddleston, 1978: 47. Fischer, 1980: 202.

Gnamptodon pumilio; Shaw & Askew, 1976: 131.

Diraphus pygmaeus Wesmael, 1838: 90, figs. 11, F.

A neotype of *Bracon pumilio* Nees, 1834, is here selected, because the original type-series is lost, it is the type-species of the genus *Gnaptodon* Haliday, 1837, and closely related species occur in the same faunal region. The hind coxae of the neotype are infuscated contrary to the original description, but Nees probably overlooked this feature.

Description of neotype, ♀, length of body and of fore wing 1.9 mm.

Head. — Antennal segments 21, length of 3rd segment 1.3 times 4th segment, length of 3rd and 4th segments 4.3 and 3.0 times their width, respectively, the penultimate segment 1.8 times its width; length of maxillary palp equal to height of head; eyes slightly emarginate (fig. 32); length of eye 2.6 times temple in dorsal view; POL : Ø ocellus : OOL = 12 : 7 : 18; frons flat, coriaceous; vertex largely smooth, convex; face rather convex (more so than in *decoris*) and laterally distinctly coriaceous (fig. 32); length of malar space 1.4 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.5 times its height; middle lobe of mesoscutum anteromedially slightly depressed (fig. 26); scutellar sulcus narrow, merely crenulate (fig. 26); medial carina of propodeum absent.

Wings. — Fore wing: $r : 3-SR : SR1 = 4 : 7 : 36$; $1-CU1 : 2-CU1 = 5 : 31$; $2-SR : 3-SR : r-m = 27 : 14 : 15$; distance of wing apex to apex of marginal cell 0.3 times vein 1-R1; length of pterostigma 1.1 times vein 1-R1 (fig. 24); vein SR1 straight (fig. 24).

Legs. — Length of femur, tibia, and basitarsus of hind leg 3.8, 9.2 and 7.5 times their width, respectively.

Metasoma. — Length of 1st tergite equal to

its apical width, its surface behind the spiracles finely rugulose and in front of the spiracles largely smooth (fig. 31); dorsal carinae of the 1st tergite present in basal half of tergite; posterior margin of transverse elevation of 2nd tergite straight medio-posteriorly, behind it rugulose; medial length of elevation of 2nd tergite 0.6 times medial length of rest of tergite; 2nd tergite with some punctures, its medial length 1.5 times medial length of 3rd tergite (fig. 31); 2nd inter-segmental suture medially deep and laterally obliterated, with a pair of obsolete, posteriorly diverging submedial grooves antero-laterally and a pair of obsolete grooves close to suture; ovipositor straight, without notch, and with a dorso-subapical nodus and some minute ventral teeth (fig. 30); length of ovipositor sheath 0.11 times fore wing.

Colour. — Black; mouthparts (including palpi), 3 basal antennal segments, tegulae, vein C + SC + R of fore wing, legs (but hind coxa largely infuscated) and metasoma ventrally, more or less yellowish-brown; pterostigma and 4th antennal segment dark brown; metasoma behind 1st tergite dorsally blackish-brown; wing membrane hyaline.

Neotype in Rijksmuseum van Natuurlijke Historie, Leiden: "Nederland, Wijster (Dr.), opposite Biol. Stat., 18—25.vi.1976, C. v. Achterberg".

Note. *Gnaptodon pumilio* (Nees) differs from *decoris*, in addition to the characters given in the key, by the distinctly setose back of the head (above the hypostomal carina) and the more convex face.

The type-series of *Diraphus pygmaeus* Wesmael, 1838, consists of one typical female specimen of *G. pumilio* (Nees) with the 2nd and 3rd tergites brownish, one female with yellowish 2nd and 3rd tergites ("var. 1" of Wesmael) and one male (probably not conspecific). The first specimen mentioned is here designated as lectotype. The lectotype has no distinct antero-lateral grooves at the 3rd tergite, the whole 1st tergite is dark brown, the 2nd metasomal suture is rather deep but smooth, the vertex is coriaceous, the 2nd tergite is distinctly sculptured and the hind coxae are yellowish.

Variation. — The variation within *pumilio* as interpreted in this paper is considerable. I have tried to split up the complex, but the results were unsatisfactory. The variation (especially of coloration) within a reared series is so extensive that any attempted division has been frustrated. Considering the available data, it is likely that

the specialisation within the complex has not resulted (yet) in recognizable species.

At least three forms can be discerned, of which form A seems to be ecologically differentiated from both other forms because it has been reared from Nepticulidae in herbs and bramble (*Rubus* spp.). The other forms have been reared from Nepticulidae in trees. I mention these three forms only to indicate the main lines of variations encountered. All characters mentioned are very variable, even within the same reared series.

Form A (including *pygmaeus* var. 1 (Wesmael)) has the 1st and 2nd tergites yellowish, with the middle of the 1st tergite usually dark brown, but sometimes the whole metasoma (except 1st tergite) is yellowish; vertex behind stemmaticum coriaceous; 2nd suture of metasoma shallow; antero-lateral grooves of 3rd tergite absent; hind coxa yellowish.

Form B has basal half of metasoma blackish or yellowish; vertex behind stemmaticum often smooth; 2nd suture of metasoma deep and crenulate; antero-lateral grooves of 3rd tergite deep and often finely crenulate; exceptionally the 3rd tergite has a separate crenulate and curved croove, directly behind 2nd suture in stead of antero-lateral grooves (this indicates that these grooves may be the result of an amalgamation of the groove and the 2nd suture in the middle of the tergite); hind coxa yellowish or infuscated. Even within series from the same host there is considerable variation. The typical form has the whole metasoma blackish-brown; vertex behind stemmaticum smooth; 2nd suture of metasoma deep and smooth (fig. 31); antero-lateral grooves of 3rd tergite incomplete, shallow and smooth; hind coxa infuscated or yellowish. Intermediates to form B occur frequently, e.g. in a series from North Italy (St. Peter, Ahrntal, 1270 m, Haeselbarth Collection).

Specimens examined: 52 ♀ and 22 ♂ (of which 7 ♀ and 4 ♂ belong to form A). Antennal segments 19—23 (of both sexes mostly 21 or 22); length of body 1.6—1.8 mm; length of fore wing 1.7—1.9 mm; 4th antennal segment yellowish, exceptionally dark brown; area behind transverse elevation of 2nd tergite smooth to rather extensively rugulose; apex of metasoma frequently reddish brown; length of pterostigma: vein 1-R1 of fore wing : distance between wing apex and apex of marginal cell of fore wing = 0.8—1.2 : 1 : 0.25—0.6. The examined specimens originate from Norway, Sweden, Great Britain (Scotland, England), Ireland,

Netherlands (Bemelen (Bemelerberg); Cadier (Schiepersberg); Castricum (dunes); 's Graveland (Ankeveense Plassen); Grevenbicht; Hilversum (heath Spanderswoud); Hulshorst (Leuvenumse Bos); Nederhorst den Berg (Spiegel-polder); Waarder; Wijster; Winterswijk), France, Italy, Austria, Hungary, Bulgaria and Greece.

Hosts: Reared from Nepticulidae in trees (form B and typical form):

in *Betula verrucosa* Ehrh.: (= *pendula* auct.)

ex *Stigmella luteella* (Stainton); U.K., Danbury, and Debden, both Essex.

in *Betula* spec.:

ex *S. betulicola* (Stainton); U.K., Thorpeness, Suffolk.

ex *S. confusella* (Wood); Norway, Åndalsnes, Møre & Romsd.

ex *S. continuella* (Stainton): Netherlands, Hilversum, heath.

ex *S. lapponica* (Wocke); Netherlands, dunes of Castricum; U.K., Delamere, Cheshire.

in *Salix caprea* L.:

ex *S. salicis* (Stainton); U.K., Benenden, Kent, (intermediate between form A and typical form, apex of metasoma partly yellowish).

in *Tilia* spec.:

ex *S. tiliae* (Frey); Hungary, Vásárosbée.

in *Ulmus procera* Salisbury:

ex *S. ulmivora* (Fologne); U.K., Hallow, Worcestershire.

in *U. glabra* Mill.:

ex Nepticulidae; Hungary, Bátorliget.

in *Ostrya carpinifolia* Scopoli:

ex *S. carpinella* (Heinemann); Greece, Oiti Oros, Fthiotis, 4 km E, pávliani, 850 m.

in *Sorbus aucuparia* L.:

ex *S. magdalenae* (Klimesch); Norway, Støren, Sør-Trøndelag, 60 m.

ex *S. sorbi* (Stainton); U.K., Blackford Hill, Edinburgh.

ex *S.* spec.; Ireland, Ballinahinch, Co. Galway.

in *Malus domestica* L.:

ex *S. malella* (Stainton); Netherlands, Grevenbicht (one ♂ has 2nd tergite yellowish, the other dark brown!).

ex *S. pomella* (Vaughan); Netherlands, Winterswijk.

in *Rhamnus catharticus* L.:

ex *S. rhamnella* (H.-S.); Hungary, Budaörs.

in *Quercus robur* L.:

ex *S. ruficapitella*-group; Netherlands, Hulshorst, Leuvenumse Bos; id., Hilversum,

heath; id., Bemelen, Bemelerberg.

ex *Ectoedemia caradjai* (Hering); France, Digne.

Form A:

in *Rubus fruticosus* agg.:

ex *Ectoedemia erythrogenella* (de Joannis); U.K., Benfleet, Essex.

ex *Stigmella splendidissima* (H.-S.) or *aurella* (F.); Netherlands, Nederhorst den Berg, Spiegel-polder; id., 's Graveland, Ankeveense Plassen, (part of series has almost whole metasoma yellowish).

in *Rubus* spec.:

from same host(s); Netherlands, Hilversum, Spanderswoud, (whole metasoma (except middle of 1st tergite) yellowish).

in *Agrimonia eupatoria* L.:

ex *S. aeneofasciella* (H.-S.); Netherlands, Cadier, Schiepersberg (part of series has whole metasoma yellowish (♀) or behind 2nd tergite blackish (♂)); Austria, Schörfing, north of Attersee.

Gnaptodon ruficeps spec. nov.

(figs. 94—102)

Holotype, ♀, length of body 1.6 mm, of fore wing 1.5 mm.

Head. — Antennal segments 21, length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3.5 and 3 times their width, respectively, penultimate segment 1.8 times its width (fig. 95); length of maxillary palp 0.8 times height of head; length of eye 1.8 times temple in dorsal view (fig. 98); POL : Ø ocellus : OOL = 12 : 7 : 18; frons slightly convex, coriaceous; vertex completely coriaceous (fig. 98); face rather convex and largely coriaceous (fig. 101); length of malar space 2.1 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.2 times its height; medio-longitudinal groove of mesoscutum absent, represented by only a wide, shallow depression (fig. 100); scutellar sulcus rather wide and deep (fig. 100); episternal scrobe shallow.

Wings. — Fore wing: $r : 3-SR : SR1 = 3 : 6 : 22$; $1-CU1 : 2-CU1 = 1 : 8$; $2-SR : 3-SR : r-m = 10 : 6 : 7$; length of pterostigma 1.5 times vein 1-R1; distance between apex of fore wing and apex of marginal cell 1.6 times vein 1-R1; vein SR1 slightly curved (fig. 96).

Legs. — Length of femur, tibia and basitarsus of hind leg 3.9, 9 and 6 times their width, respectively.

Metasoma. — Length of 1st tergite 0.6 times its apical width, its surface superficially coriaceous; dorsal carinae present in basal half of 1st tergite (fig. 102); basal elevation of 2nd tergite indistinct, its medial length 0.5 times rest of tergite; 2nd tergite behind elevation and rest of metasoma largely coriaceous (fig. 94); 2nd suture deep, smooth and distinctly bent (fig. 102); 3rd tergite with no antero-lateral grooves; medial length of 3rd tergite 0.8 times medial length of 2nd tergite (fig. 102); length of ovipositor sheath 0.08 times fore wing.

Coulour. — Yellowish-brown; stemmaticum, antenna (but scapus largely yellowish), mesosoma (but propleuron, mesopleuron dorsally and metapleuron brownish), and pterostigma, dark brown; vertex (partly) and telotarsi, infuscated.

Holotype in Museum Budapest: "Nagykovácsi (= Hungary), 1967, vii.9, Szöcs J.", "ex *Nepticula dorycniella* Suire", "*Dorycnium germanicum*".

Host: *Trifurcula dorycniella* (Suire) in *Dorycnium germanicum* (Grenli).

***Gnaptodon vlugi* spec. nov.**
(figs. 64—72)

Holotype, ♂, length of body 1.2 mm, of fore wing 1.4 mm.

Head. — Antennal segments 18, antenna widened apically (fig. 64), length of 3rd segment 1.1 times 4th segment, length of 3rd and 4th segments 3.5 and 3.2 times their width, respectively, penultimate segment 2.2 times its width (fig. 66); length of maxillary palp 0.9 times height of head; length of eye 1.7 times temple in dorsal view (fig. 71); POL : Ø ocellus : OOL = 16 : 8 : 19; frons almost smooth, slightly depressed behind antennal sockets; vertex largely smooth; face largely smooth, laterally indistinctly micro-sculptured, rather convex (fig. 68); length of malar space equal to basal width of mandible.

Mesosoma. — Length of mesosoma 1.3 times its height; medio-longitudinal groove of mesoscutum shallow but distinct (fig. 69); scutellar sulcus rather wide, distinctly crenulate (fig. 69); episternal scrobe deep (fig. 64).

Wings. — Fore wing: $r : 3\text{-SR} : \text{SR1} = 6 : 11 : 54$; $1\text{-CU1} : 2\text{-CU1} = 3 : 11$; $2\text{-SR} : 3\text{-SR} : r\text{-m} = 24 : 11 : 16$; length of pterostigma 1.9 times vein 1-R1; distance between apex of fore wing and apex of marginal cell 2.2 times vein 1-R1 (fig. 65); vein SR1 straight.

Legs. — Length of femur, tibia and basitarsus

of hind leg 3.6, 6.6 and 5.2 times their width, respectively.

Metasoma. — Length of 1st tergite 0.9 times its apical width, its surface smooth, and dorsal carinae obsolescent (fig. 72); basal elevation of 2nd tergite weakly differentiated, strongly transverse, its medial length 0.4 times medial length of rest of tergite (fig. 72); 2nd tergite behind elevation coriaceous but posteriorly smooth; medial length of 2nd tergite 1.2 times medial length of 3rd tergite; 3rd tergite smooth and with shallow and smooth antero-lateral grooves (fig. 72); 2nd suture deep, medially distinctly crenulate.

Colour. — Black; palpi, legs (except infuscated telotarsi), 5 basal segments of antenna, tegulae, 1st and 2nd tergites, antero-lateral corners of 3rd tergite and anterior half of metasoma ventrally, ivory-whitish; pterostigma brown; rest of antenna (dark) brown.

Holotype in Rijksmuseum van Natuurlijke Historie, Leiden: "Sweden, Hallandsl., Särö-Hamra, swept, 26.6.1977, leg. H. J. Vlуг". It is a pleasure to me to dedicate this species to its collector, Mr. H. J. Vlуг (Scherpenzeel).

THE ECOLOGY OF THE REARED PALAEARCTIC
GNAPTODON SPECIES

As shown in fig. 131, if reared more than once, the hosts of *Gnaptodon* species are usually found on plants of several families. Obviously the parasites do not select certain plant groups. If the host plants are arranged according to their morphology (trees, (low) shrubs, and (non-woody) herbs), however, the picture changes (fig. 130). The assignment of host plants of the Nepticulidae to a tree, shrub, or herb zone is, of course rough: the low shoots of a tree may be lower than a large herb, and the same applies for a dwarf shrub. Nevertheless, the species seem to select for a certain vegetation zone; if more than one zone is included (e.g. *pumilio*, no. 1 in fig. 130) then the specimens in another zone are aberrant in colour and/or morphology with respect to the nominate form (e.g. form A of *pumilio* in herbs) and may constitute already a good biological species or be in the process of active sympatric speciation.

If two morphologically very close species occur in the same zone (nos 3 and 5 in fig. 130) then one of the species is specialized: in this case no. 5 (*pilosus*) seems to be restricted to Nepticulidae in *Quercus*, while no. 3 (*georginae*) parasitizes Nepticulidae in other trees (and high

shrubs). In the case of *erasmi* (no. 6) and *nieuwerkerkeni* (no. 7), the latter seems to be restricted to dwarf shrubs among rocks at high altitude. *G. erasmi* is known from 100—150 m altitude and occurs in higher shrubwood.

Summarizing, the selection of a vegetation zone is of major importance. Within one zone closely related species are ecologically separated because of their preference to a certain host-plant (*pilosus* in *Quercus*, *georginae* in other trees) or to a certain altitude (*erasmi* at low altitude, *nieuwerkerkeni* at high altitude). Obviously a lot of research, especially cross-breeding experiments, still has to be done before definitive conclusions can be drawn.

B. AFROTROPICAL REGION

KEY TO AFROTROPICAL SPECIES OF THE GENUS *GNAPTODON* HALIDAY

1. Second tergite of metasoma with distinct transverse elevation basally (figs. 119, 128); length of vein SR1 of fore wing 7—10.5 times vein 3-SR (figs. 114, 122) 2
- Second tergite with no distinct transverse elevation basally; length of vein SR1 of fore wing about 3 times vein 3-SR *unifossa* Fischer
2. Distance between fore wing apex and apex of marginal cell about 0.7 times vein 1-R1 (metacarp); length of pterostigma about 1.1 times vein 1-R1; length of vein SR1 of fore wing about 10 times vein 3-SR (fig. 122); 1st tergite largely aciculate-rugulose (fig. 128); antenna comparatively slender basally (fig. 121) *similis* spec. nov.
- Distance between fore wing apex and apex of marginal cell about 1.3 times vein 1-R1; length of pterostigma 1.5—1.9 times vein 1-R1; length of vein SR1 of fore wing 7—8 times vein 3-SR (fig. 114); 1st tergite largely smooth (fig. 119); antenna rather robust basally (fig. 112) *bini* spec. nov.

Gnaptodon bini spec. nov. (figs. 112—120)

Holotype, ♀, length of body, and of fore wing 1.1 mm.

Head. — Antennal segments 14, length of 3rd segment 1.3 times 4th segment, length of 3rd and 4th segments 2.5 and 2.0 times their width, respectively, penultimate segment 1.8 times its width; length of maxillary palp 0.8 times height of head; length of eye 1.9 times temple in dorsal view, POL : Ø ocellus : OOL = 9 : 4 : 10;

frons slightly impressed, coriaceous (figs. 116, 117); vertex coriaceous; face rather convex, laterally coriaceous, rest smooth (fig. 117); length of malar space 1.2 times basal width of mandible

Mesosoma. — Length of mesosoma 1.4 times its height; medio-longitudinal groove of mesoscutum absent; scutellar sulcus narrow (fig. 120); episternal scrobe obsolescent (fig. 112).

Wings. — Fore wing: $r : 3\text{-SR} : 3\text{-R1} = 5 : 10 : 68$; $1\text{-CU1} : 2\text{-CU1} = 3 : 26$; $2\text{-SR} : 3\text{-SR} : r\text{-m} = 25 : 10 : 11$; length of pterostigma 1.9 times vein 1-R1; distance between wing apex and apex of marginal cell 1.4 times vein 1-R1; vein SR1 slightly curved.

Legs. — Length of femur, tibia and basitarsus of hind leg 3.2, 6.3 and 4 times their width, respectively.

Metasoma. — Length of 1st tergite 0.7 times its apical width, its surface smooth; dorsal carinae of 1st tergite obsolescent (fig. 119); basal elevation of 2nd tergite slightly developed medially, rest of 2nd tergite and 3rd tergite coriaceous, rest of metasoma largely transversely micro-aciculate (fig. 112); medial length of basal elevation of 2nd tergite 0.4 times rest of tergite; medial length of 2nd tergite 0.9 times length 3rd tergite (fig. 119); 2nd suture deep, smooth, 3rd tergite with no antero-lateral grooves; length of ovipositor sheath 0.08 times fore wing.

Colour. — Blackish or dark brown; clypeus ventrally, mandibles, 4 basal segments of antenna, tegula, legs (but fore and middle telotarsi and hind tarsus infuscated), and 3 basal segments of metasoma, brownish-yellow; rest of metasoma dark brown; humeral plate whitish; pterostigma dark brown; palpi whitish.

Holotype in Rijksmuseum van Natuurlijke Historie, Leiden: "Somalia, Afgoi, iv.1977. Lower Shabelli Valley, F. Bin". Additional material: 1 ♀ (non-type), in same institute, topotypic, length of fore wing 1 mm, antennal segments 16, robust antenna as holotype (length of 3rd and 4th segments 2.5 and 2 times their width, respectively), length of pterostigma 1.5 times vein 1-R1, distance between apex of fore wing and apex of marginal cell 1.3 times vein 1-R1; hind tarsus and whole metasoma yellowish; head (except stemmaticum) brownish-yellow; 1st tergite with some micro-aciculae. Not labelled as paratype because of aberrant coloration.

Note. The combination of the short distance between the apex of the fore wing and the apex of the marginal cell, the short vein 1-R1, and the

low number of antennal segments, differentiates it from the known Palearctic species. The only Oriental species (described in this paper) differs e.g. by its slender pterostigma. I am pleased to dedicate this species to Dr. F. Bin (Perugia), who collected several interesting Braconidae in Somalia.

Gnaptodon similis spec. nov.
(figs. 121—129)

Holotype, ♀, length of body 1.2 mm, of fore wing 1.3 mm.

Head. — Antennal segments 17, length of 3rd segment 1.2 times 4th segment, length of 3rd and 4th segments 3 and 2.5 times their width, respectively, penultimate segment 2.3 times its width (fig. 123); length of maxillary palp 0.8 times height of head; length of eye 1.1 times temple in dorsal view; POL : Ø ocellus : OOL = 6 : 3 : 8; frons slightly impressed, coriaceous; vertex strongly shiny, coriaceous (fig. 124); face rugulo-coriaceous laterally, rest smooth, rather convex (fig. 125); length of malar space equal to basal width of mandible.

Mesosoma. — Length of mesosoma 1.4 times its height; medio-longitudinal groove of mesoscutum absent (fig. 129); scutellar sulcus narrow, merely finely crenulate (fig. 129); episternal scrobe small and shallow.

Wings. — Fore wing: $r : 3-SR : SR1 = 4 : 4 : 42$; $1-CU1 : 2-CU1 = 1 : 11$; $2-SR : 3-SR : r-m = 14 : 4 : 10$; length of pterostigma 1.1 times vein 1-R1 (fig. 122); distance between wing apex and apex of marginal cell 0.7 times vein 1-R1; vein SR1 straight (fig. 122).

Legs. — Length of femur, tibia, and basitarsus of hind leg 3.6, 6.2 and 4.5 times their width, respectively.

Metasoma. — Length of 1st tergite equal to its apical width, its surface largely aciculate-rugulose (fig. 128); dorsal carinae distinct in basal half of 1st tergite; basal elevation of 2nd tergite distinct, posteriorly straight (fig. 128), its medial length 0.3 times length of rest of tergite; 2nd tergite medially and 3rd tergite basally coriaceous, rest of metasoma smooth (fig. 121); 2nd suture deep and smooth; medial length of 2nd tergite 1.1 times length of 3rd tergite; length of ovipositor sheath 0.08 times fore wing.

Colour. — Brownish-yellow; 6th—17th antennal segments, 3rd and 4th metasomal tergites, ovipositor sheath and stemmaticum, dark brown or blackish; mesosoma and rest of metasoma, brown; pterostigma rather light brown.

Holotype in British Museum (Natural History),

London: "Port St. John(s), Pondoland, April 5—30, 1923", "S. Africa, R. E. Turner, Brit. Mus., 1923—286".

Note. Resembles the Palearctic *G. decoris*, but *similis* has vein SR1 of fore wing straight, head and base of antenna yellowish, metasoma distinctly sculptured, and fewer antennal segments (20—23 in *decoris*).

C. ORIENTAL REGION

Gnaptodon orientalis spec. nov.
(figs. 34—43)

Holotype, ♀, length of body 1.0 mm, of fore wing 1.2 mm.

Head. — Antennal segments 19, length of 3rd segment 1.3 times 4th segment, length of 3rd and 4th segments 3.3 and 2.5 times their width, respectively; penultimate segment 2.3 times its width (fig. 41); length of maxillary palp 0.6 times height of head; length of eye 2.6 times temple in dorsal view; POL : Ø ocellus : OOL = 8 : 4 : 12; frons virtually flat and smooth; vertex convex and smooth; face rather convex and smooth; length of malar space 1.5 times basal width of mandible.

Mesosoma. — Length of mesosoma 1.2 times its height; mesoscutal lobes evenly setose, without medial depression (fig. 42); scutellar sulcus narrow and virtually smooth (fig. 42).

Wings. — Fore wing: $r : 3-SR : SR1 = 3 : 4 : 41$; $1-CU1 : 2-CU1 = 3 : 25$; $2-SR : 3-SR : r-m = 11 : 4 : 8$; length of pterostigma 1.4 times vein 1-R1; length of distance between apex of wing and apex of marginal cell 0.8 times vein 1-R1 (fig. 37); pterostigma slender (fig. 37; all other spp. treated in this paper have the pterostigma more robust (figs. 13, 20, 24)); vein SR1 slightly curved (fig. 37).

Legs. — Length of femur, tibia, and basitarsus of hind leg 3.5, 8.0, and 5.5 times their width, respectively.

Metasoma. — Length of 1st tergite equal to its apical width, its surface largely smooth, with dorsal carinae developed in basal two-thirds of tergite (fig. 43); curved transverse elevation of 2nd tergite distinct, in front smooth, behind it superficially coriaceous (fig. 43); 2nd intersegmental suture of metasoma medially distinct, smooth, with no additional grooves; setae rather sparse and spread; ovipositor straight, with nodus subapically (fig. 34); length of ovipositor sheath 0.05 times fore wing.

Colour. — Yellowish-brown; antenna (except scapus); stemmaticum, mesoscutum

largely, 3rd-5th tergites medially, ovipositor sheath, pterostigma, and vein 1-R1, dark brown; rest of veins brown; scutellum, medial part of metanotum, propodeum, and 1st tergite basally, hind tarsus and telotarsi, infuscated; wing membrane hyaline.

Holotype in Bernice P. Bishop Museum, Honolulu: "Thailand: Trang Prov., Khaophappa Khaochang, 200 m., 11—15.i.1964", "G. A. Samuelson, Malaise Trap, Bishop".

Note. — *G. orientalis* spec. nov. runs in my key to the Palearctic species to *G. decoris* (Foerster); however, *orientalis* differs by the more slender pterostigma and longer marginal cell of the fore wing (fig. 37 versus fig. 20), the yellowish head and base of the metasoma, and by the (nearly) smooth face and 1st tergite (both more or less sculptured in *decoris*). Of the Afrotropical spp., it most resembles *G. similis* spec. nov. from S. Africa; however, *orientalis* differs by the slender pterostigma and marginal cell of fore wing (fig. 37 versus fig. 122) and by the smooth 1st tergite (fig. 43 versus fig. 128). It runs in the key to the Australian species of *Gnaptodon* by Fischer (1978: 397—398) to *G. novobritannicus* Fischer, 1971, because of the rather evenly setose mesoscutum. However, *G. novobritannicus* is not closely related; it has a longer ovipositor sheath (longer than half length of metasoma), longer maxillary palp (equal to height of head), more antennal segments (26 in holotype), different colour (mesosoma black), and is twice as large. Additionally *G. novobritannicus* has a weakly developed ventral part of the occipital carina and the propodeum has a medial carina.

PHYLOGENETIC RELATIONSHIPS

The Gnaptodontinae may be easily mistaken for a group of the Opiinae because of the absence of the prepectal carina, the almost flat and glabrous labrum, and the presence of a shallow hypoclypeal depression. However, the wing venation, the more or less developed transverse elevation of the 2nd metasomal tergite, the pit in front of the propodeal spiracle, and the 3-segmented labial palp of the Gnaptodontinae would be aberrant within the Opiinae. Also the biology is aberrant; Opiinae are obligatory larval endoparasites of Diptera, while the Gnaptodontinae (as far as known) are obligatory (?endo)parasites of Nepticulidae (Lepidoptera).

The cephalic structures of the final instar larva of *Gnaptodon* are fairly complete and include robust and toothed mandibles (fig. 43 in Čapek,

1970). The mandibles of the larvae of Opiinae are slender and toothless. The toothed mandibles of the larvae of the Gnaptodontinae are peculiar (if it is a real endoparasite), because endoparasites such as Opiinae, Alysini and the endoparasitic groups, e.g. of the Rogadinae, have smooth mandibles. This may indicate that *Gnaptodon* actually is an ectoparasite, which glues the egg to the host's intersegmental membrane (as in the ectoparasitic *Rhysipolis*; Dr. M. R. Shaw, in litt.). A really sound and accurate proof that *Gnaptodon* is an endoparasite has not yet been obtained; it is only deduced from circumstantial evidence (e.g. the host remains look as though an endoparasite has been there and the parasitized host is mobile and able to spin a cocoon when it leaves the mine). The delicate cocoon of *Gnaptodon* is formed in the cocoon of the host.

The cephalic structures of the larvae of some ectoparasitic Rogadinae are similar to those of the Gnaptodontinae. However, the similarity is based on symplesiomorphous character-states (e.g., the toothed mandibles). The cephalic structures of the larvae of Gnaptodontinae are completely different from the more or less reduced cephalic structures of the larvae of Opiinae. Despite this evidence Fischer (1970, 1972 & 1977) and Tobias (1976a, not 1976b) favour the inclusion of the Gnaptodontinae as a tribe in the Opiinae, because, for example, the transverse elevation of the 2nd tergite is considered to be too aberrant an evolutionary tendency to include it in the Rogadinae (Fischer, 1972: 56) as proposed by Čapek (1970). Peculiarly, it is forgotten that this evolutionary tendency is also absent in the Opiinae. Fischer (1972: 56) provisionally retains his Gnaptodontini in the Opiinae because of "konventionellen Gründen".

Within the Rogadinae the Gnaptodontinae would fit in near the Exothecini. The synapomorphous character-states shared with the Exothecini are the absence of the prepectal carina and the precoxal sulcus, and the scarcely developed laterope. Unfortunately these are all reductions and such "negative apomorphous character-states" are comparatively less reliable for a phylogenetic arrangement than "positive apomorphous character-states", such as the peculiar curved transverse elevation of the 2nd tergite in the Gnaptodontinae. The only positive synapomorphy with the Exothecini is in the biology and then only in being parasites of leaf-miners.

The morphology of the Gnaptodontinae (as

far as I have examined the group) seems too derived to give any firm clue about its sister-group. An exception may be the rather flat labrum combined with the transverse, rather shallow hypoclypeal depression (figs. 6, 14), which is aberrant for (almost all of) the Rogadinae and normal for a large part of the Opiinae. The only alternative to its inclusion in the Rogadinae or in the Opiinae seems to be to consider it an old archaic subfamily, and the presence of rather numerous species both in the Australian and Palaearctic regions supports this view. Thus the Gnaptodontinae are considered to have branched off somewhere from the stem of group B (Van Achterberg, 1976, fig. 123), which includes the Opiinae and Alysiniinae. All of the group B are now exclusively parasites of Diptera and originally endoparasites of mining larvae of Diptera (as the majority of the Opiinae still are). Later they switched to larvae in (more or less decaying) fruits, followed by accepting hosts in decaying vegetable matter (e.g. dung), and finally in decaying animal matter (carrion). It is interesting to note that the Gnaptodontinae are (still) specialized (?ecto)parasites of mining larvae of an archaic group of Lepidoptera; this makes it likely that the Gnaptodontinae branched off before the Opiinae became specialized on dipterous hosts (and if *Gnaptodon* is an ectoparasite, even before the development of endoparasitism), since the group from which the Gnaptodontinae, Opiinae and Alysiniinae stem seems to consist of solitary ectoparasites of various orders, including Lepidoptera and Diptera, as still are found in the Rogadinae.

Another problem is the position of the group B within the Braconidae. Tobias (1967, fig. 43) placed it as a sister-group of the Helconinae, while Čapek (1970) and Van Achterberg (1976) considered the group a branch of the "cyclostome"-group, including the Rogadinae. The latter view has recently gained much support from the work of Edson & Vinson (1979) on the morphology of the venom apparatus of the female. The venom apparatus of the Opiinae and Alysiniinae is similar to that of the Rogadinae and different from the venom apparatus of the Helconinae. Unfortunately the venom apparatus of the Gnaptodontinae remains still to be investigated; thus its similarity to that of the Opiinae remains to be proved.

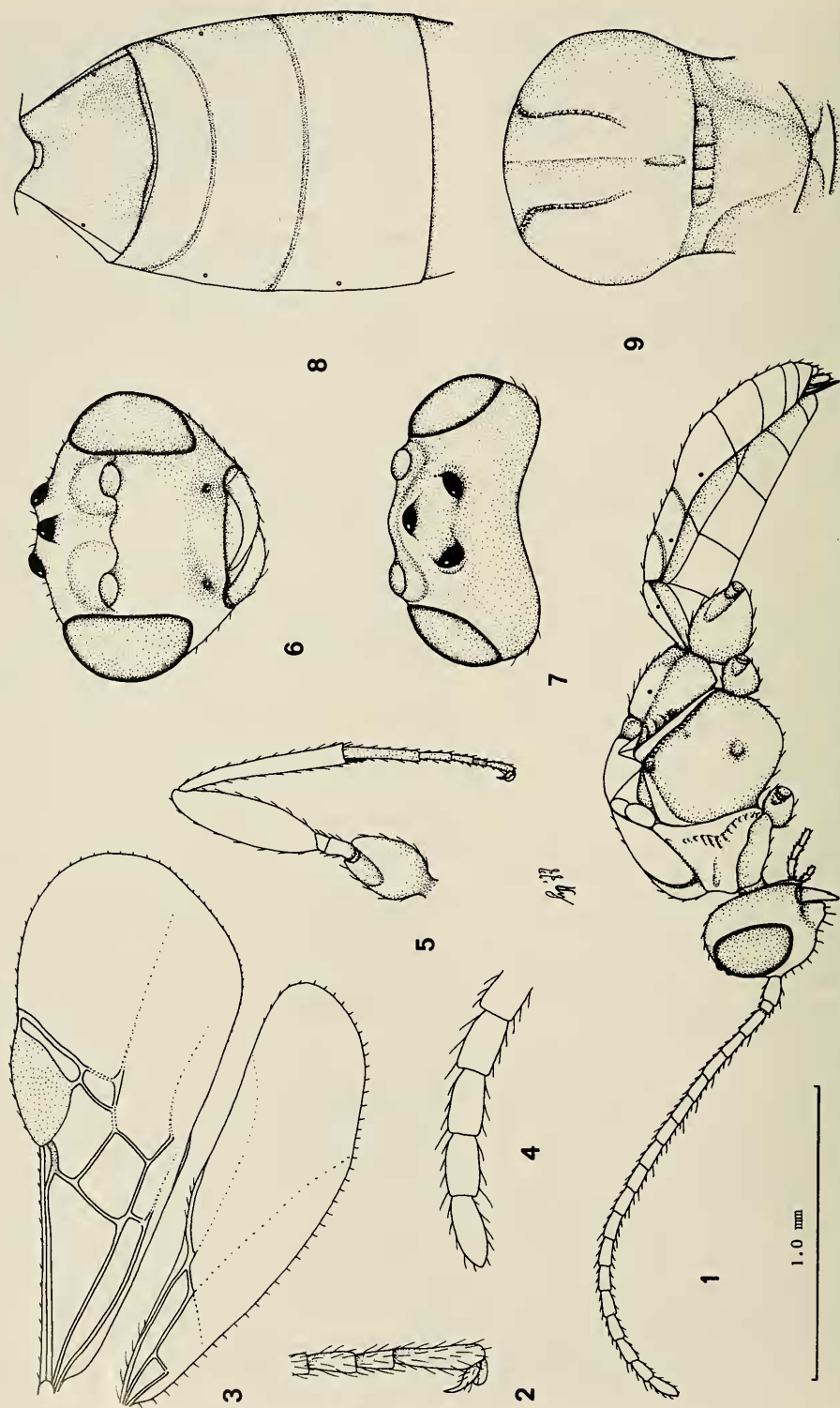
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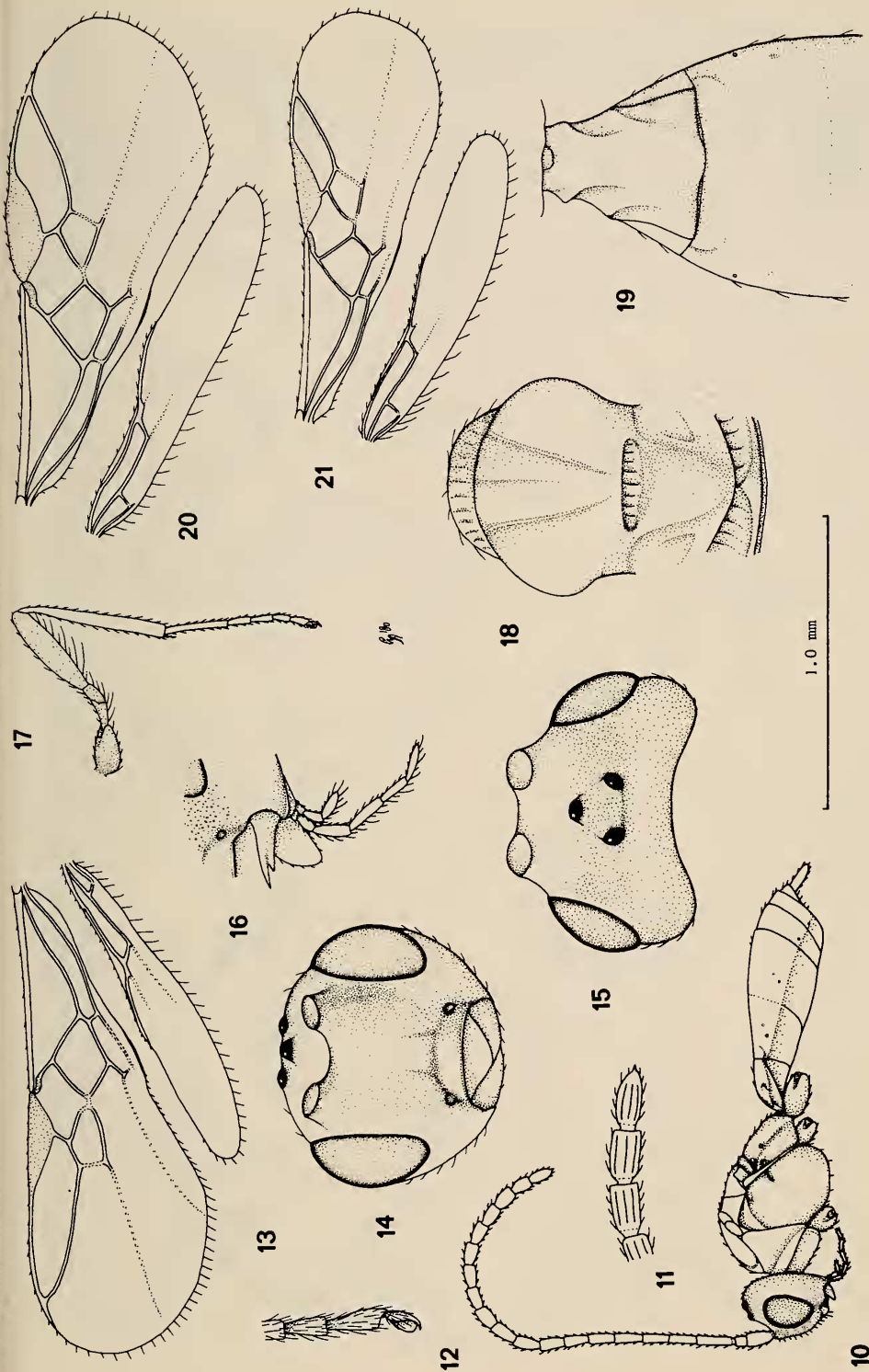
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CHECKLIST OF NAMES USED IN THE GENUS *GNAPTODON* HALIDAY

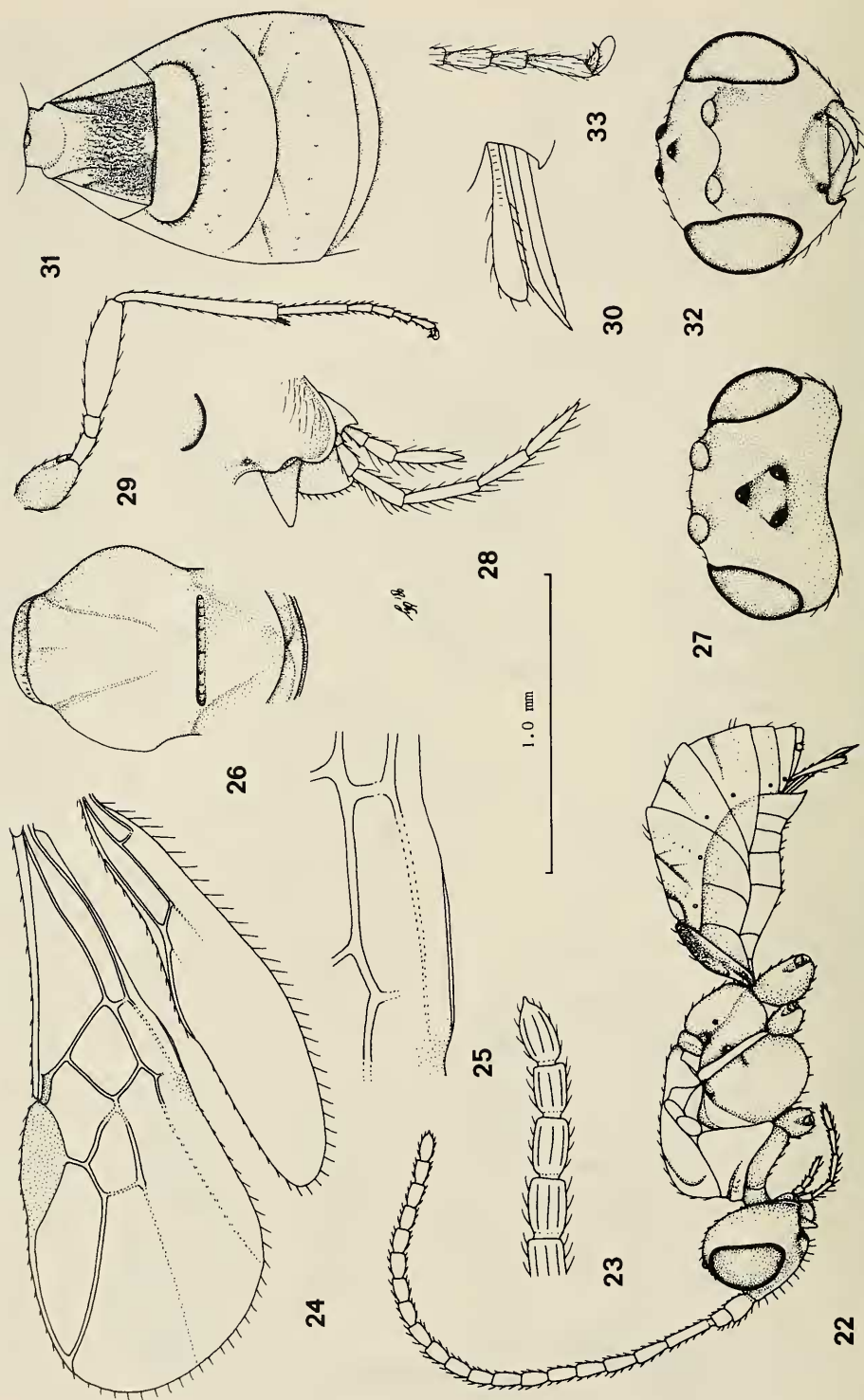
Name	Type-locality	page
<i>apheles</i> spec. nov.	North Italy	29
<i>bachmaieri</i> (Fischer, 1957)	West Germany	31
<i>bicolor</i> Fischer, 1965	U.S.A. (North Carolina)	29
<i>bini</i> spec. nov.	Somalia	39
<i>breviradialis</i> Fischer, 1959	Hungary	30
<i>brevis</i> spec. nov.	Hungary	30
<i>catamaranensis</i> Fischer, 1978	Tasmania	—
<i>clarimacula</i> Fischer, 1978	Tasmania	—
<i>decoris</i> (Foerster, 1862)	West Germany	31
<i>dispar</i> Fischer, 1978	Tasmania	—
<i>erasmi</i> spec. nov.	North Italy	32
<i>georginae</i> spec. nov.	Algeria	33
<i>glaber</i> Fischer, 1965	U.S.A. (Florida)	29, 35
<i>klemensiewiczii</i> Niezabitowski, 1910	Poland	31
<i>longicauda</i> Fischer, 1965	U.S.A. (Maryland)	—
<i>nepalicus</i> Fischer, 1966	Nepal	34
<i>nepticulae</i> (Rohwer, 1915)	U.S.A. (Virginia)	29
<i>nieukerkeni</i> spec. nov.	Greece	34
<i>novobritannicus</i> Fischer, 1978	Bismarck Archipelago	41
<i>novotesticus</i> Fischer, 1967	Brazil	29
<i>orientalis</i> spec. nov.	Thailand	40
<i>pilosus</i> spec. nov.	Hungary	34
<i>pulchrigaster</i> Fischer, 1965	U.S.A. (New York)	29
<i>pumilio</i> (Nees, 1834)	Netherlands (neotype)	35
<i>pygmaeus</i> (Wesmael, 1838)	Belgium	35
<i>recticarinatus</i> Fischer, 1965	Canada (Yukon Terr.)	—
<i>rotundincisus</i> Fischer, 1978	Tasmania	—
<i>ruficeps</i> spec. nov.	Hungary	37
<i>rugulosus</i> Fischer, 1965	U.S.A. (New York)	—
<i>similis</i> spec. nov.	South Africa	40
<i>sinuatus</i> Fischer, 1965	Canada (Yukon Terr.)	—
<i>talumalaensis</i> Fischer, 1978	Bismarck Archipelago	—
<i>tasmanicus</i> Fischer, 1978	Tasmania	—
<i>tricrenulatus</i> Fischer, 1978	Tasmania	—
<i>unifossa</i> Fischer, 1963	Tasmania	39
<i>vlugi</i> spec. nov.	Sweden	38



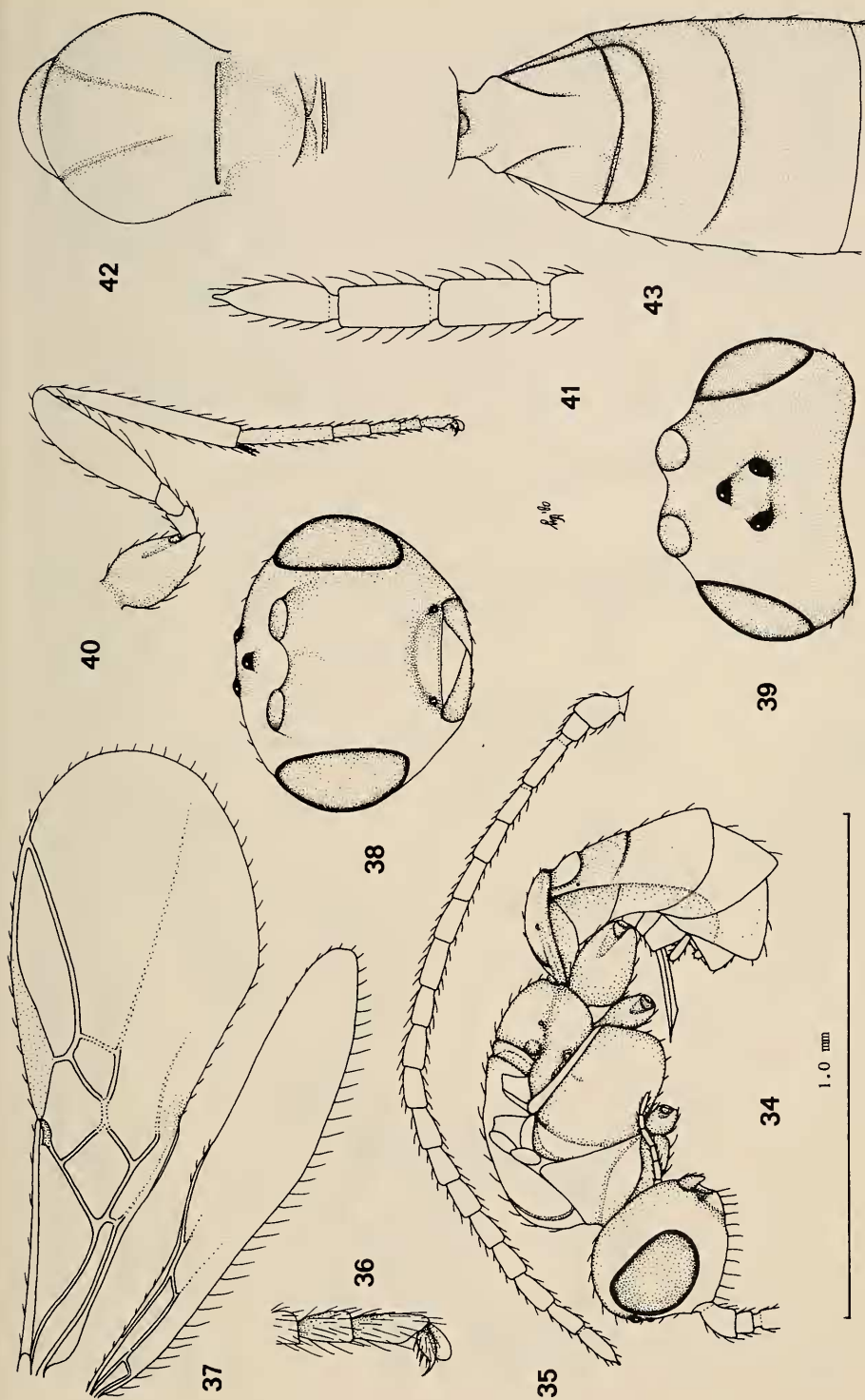
Figs. 1—9. *Gnaptogaster mongolica* Tobias, paratype, ♀. 1; habitus, lateral aspect; 2, hind claw; 3, wings; 4, apex of antenna; 5, hind leg; 6, head, frontal aspect; 7, head, dorsal aspect; 8, 1st—3rd tergites, dorsal aspect; 9, meso- and metanotum, dorsal aspect. 1, 3, 5: scale-line, $1 \times$; 2, 4: $2.5 \times$; 6—9: $1.7 \times$.



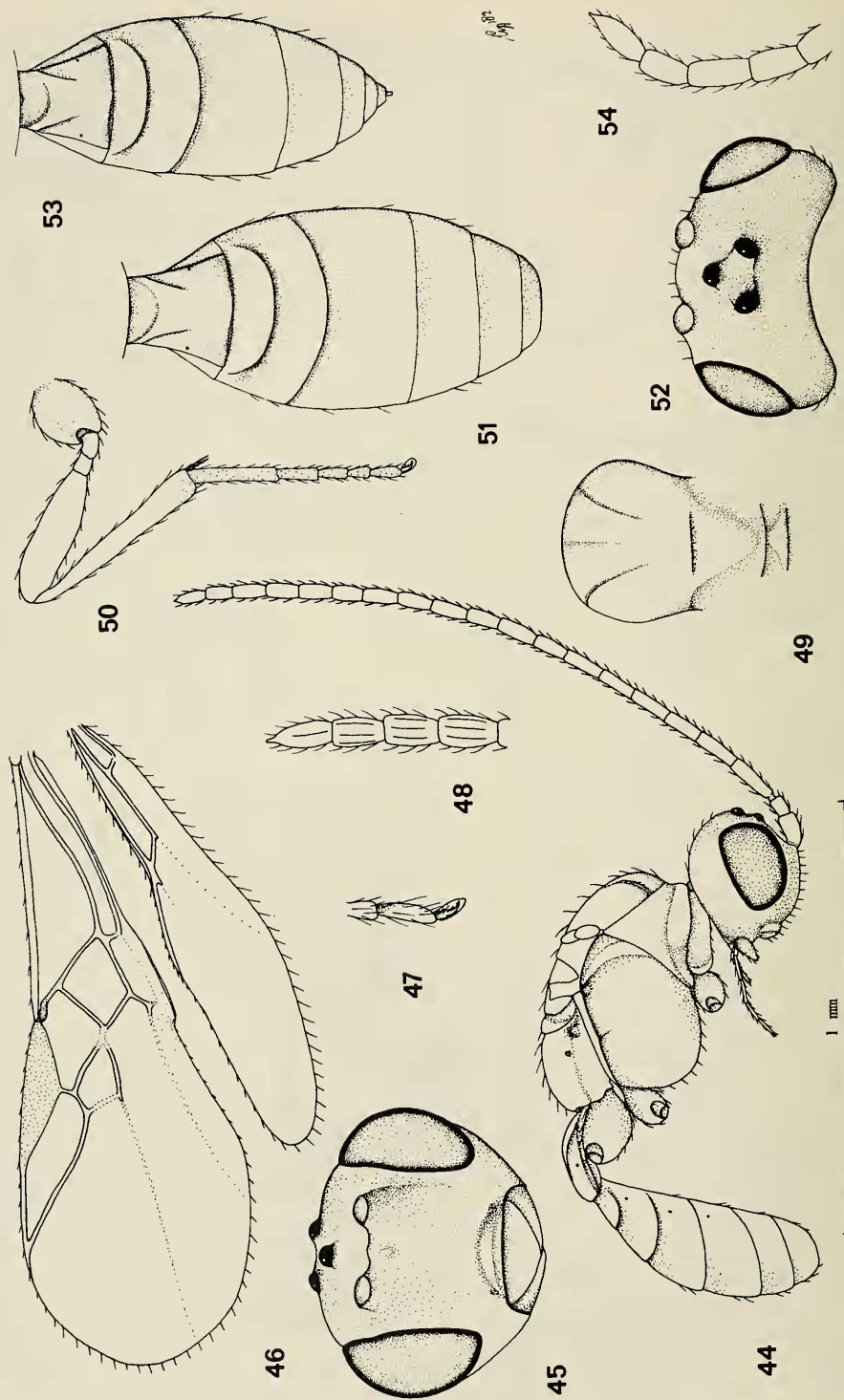
Figs. 10—19. *Gnaptodon apheles* spec. nov., holotype, ♀. 10. habitus, lateral aspect; 11, apex of antenna; 12, hind leg; 13, wings; 14, head, frontal aspect; 15, head, dorsal aspect; 16, palpi; 17, hind leg; 18, thorax, dorsal aspect; 19, 1st and 2nd tergites, dorsal aspect. Fig. 20. *Gnaptodon decoris* (Foerster), Netherlands, Wijster, ♀, paratype, ♂, wings (somewhat artificially bent). 10, 13, 17, 20, 21: scale-line, 1 ×; 11, 12, 14—16, 18, 19: 1.5 ×.



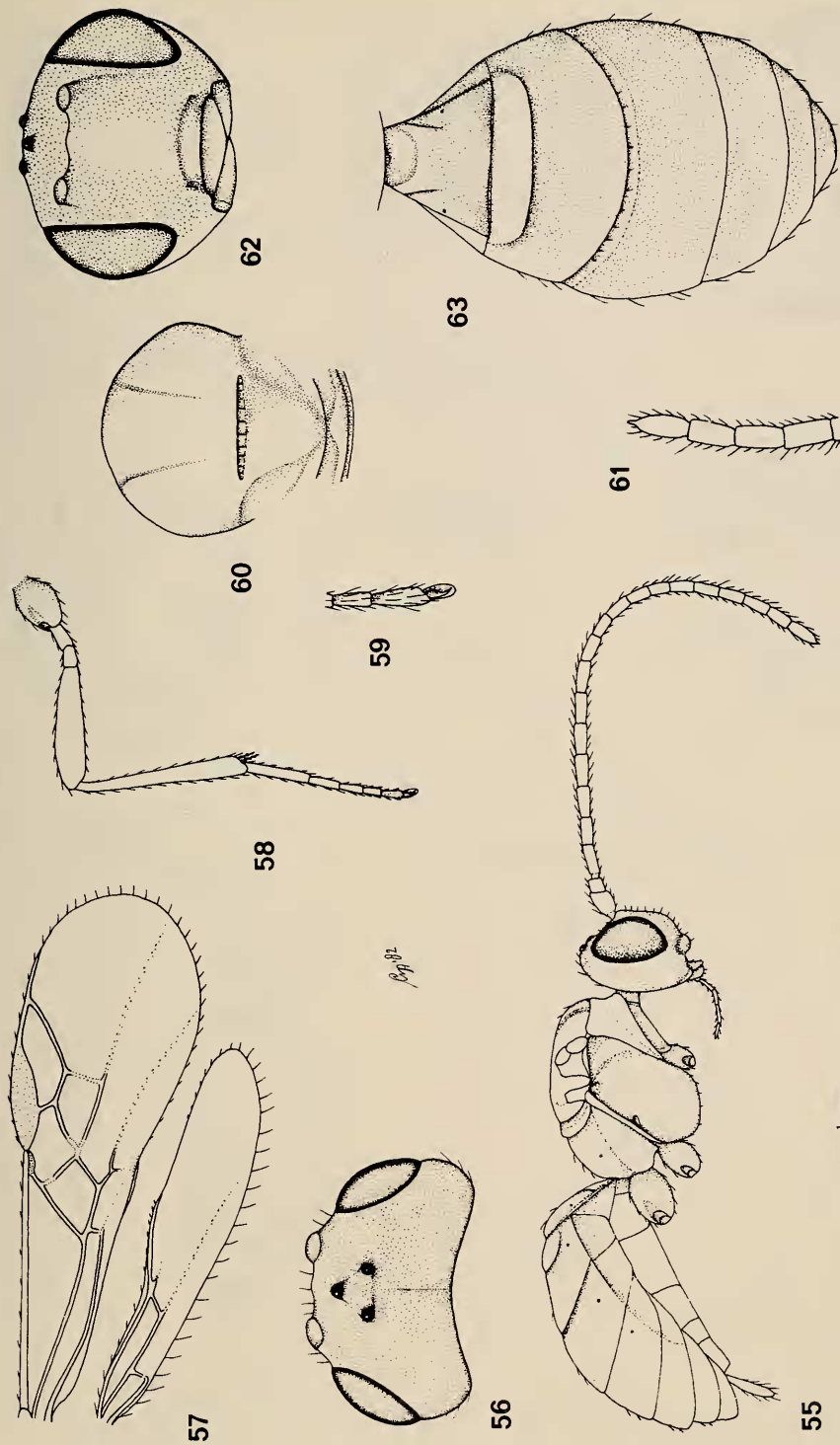
Figs. 22—33. *Gnaptodon pumilio* (Nees), neotype, ♀. 22, habitus, lateral aspect; 23, apex of antenna; 24, wings; 25, 1st subdiscal cell of fore wing; 26, thorax, dorsal aspect; 27, head, dorsal aspect; 28, palpi; 29, hind leg; 30, ovipositor, lateral aspect; 31, 1st—3rd tergites, dorsal aspect; 32, head, frontal aspect; 33, hind claw. 22, 24, 29: scale-line, 1 ×; 23, 25, 28, 30, 33: 2.5 ×; 26, 27, 31, 32: 1.6 ×.



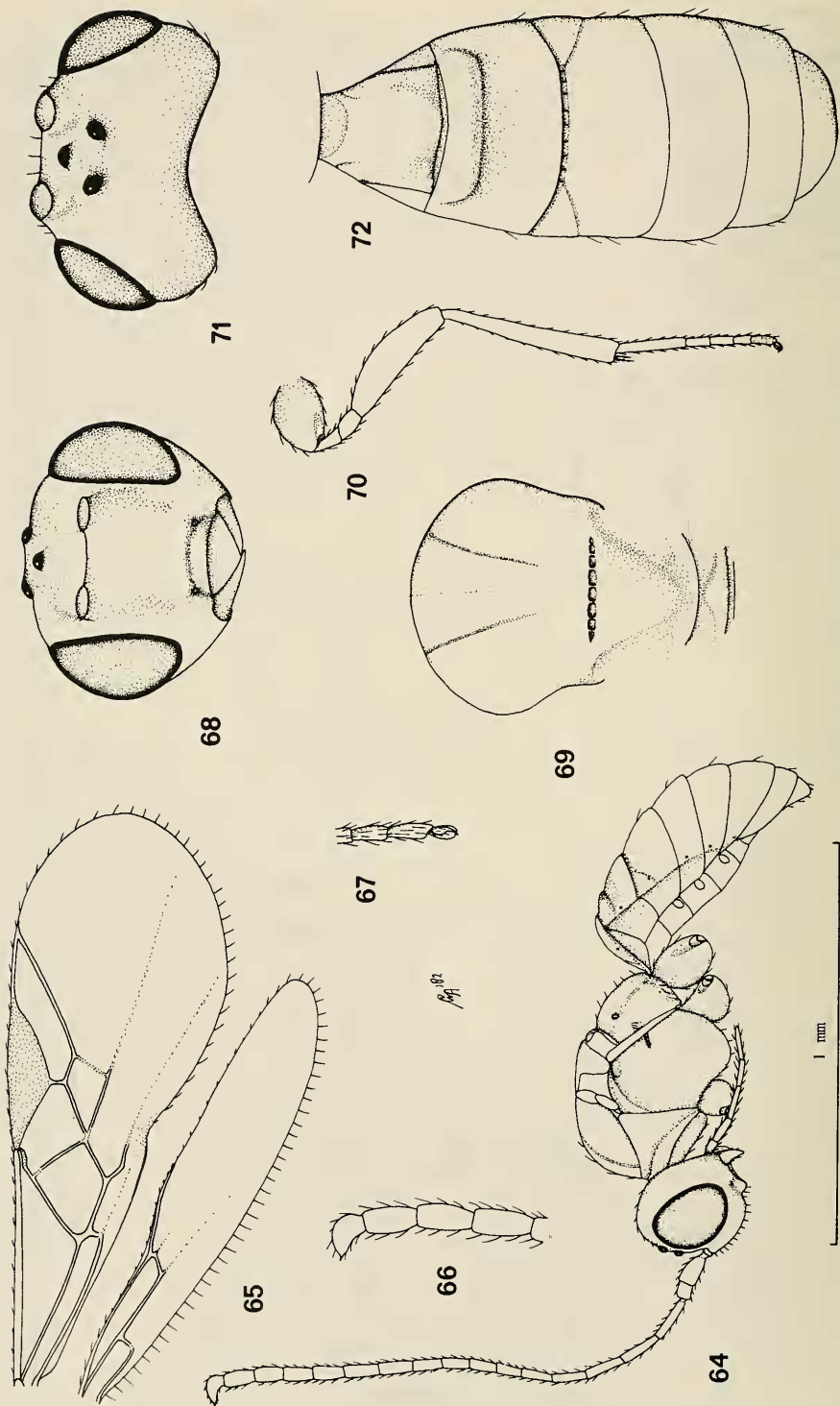
Figs. 34—43. *Gnaptodon orientalis* spec. nov., holotype, ♀. 34, habitus, lateral aspect; 35, antenna; 36, hind claw; 37, wings; 38, head, frontal aspect; 39, head, dorsal aspect; 40, hind leg; 41, apex of antenna; 42, thorax, dorsal aspect; 43, 1st—3rd tergites, dorsal aspect. 34, 35, 37, 40: scale-line, 1 ×; 36, 41: 2.5 ×; 38, 39, 42, 43: 1.5 ×.



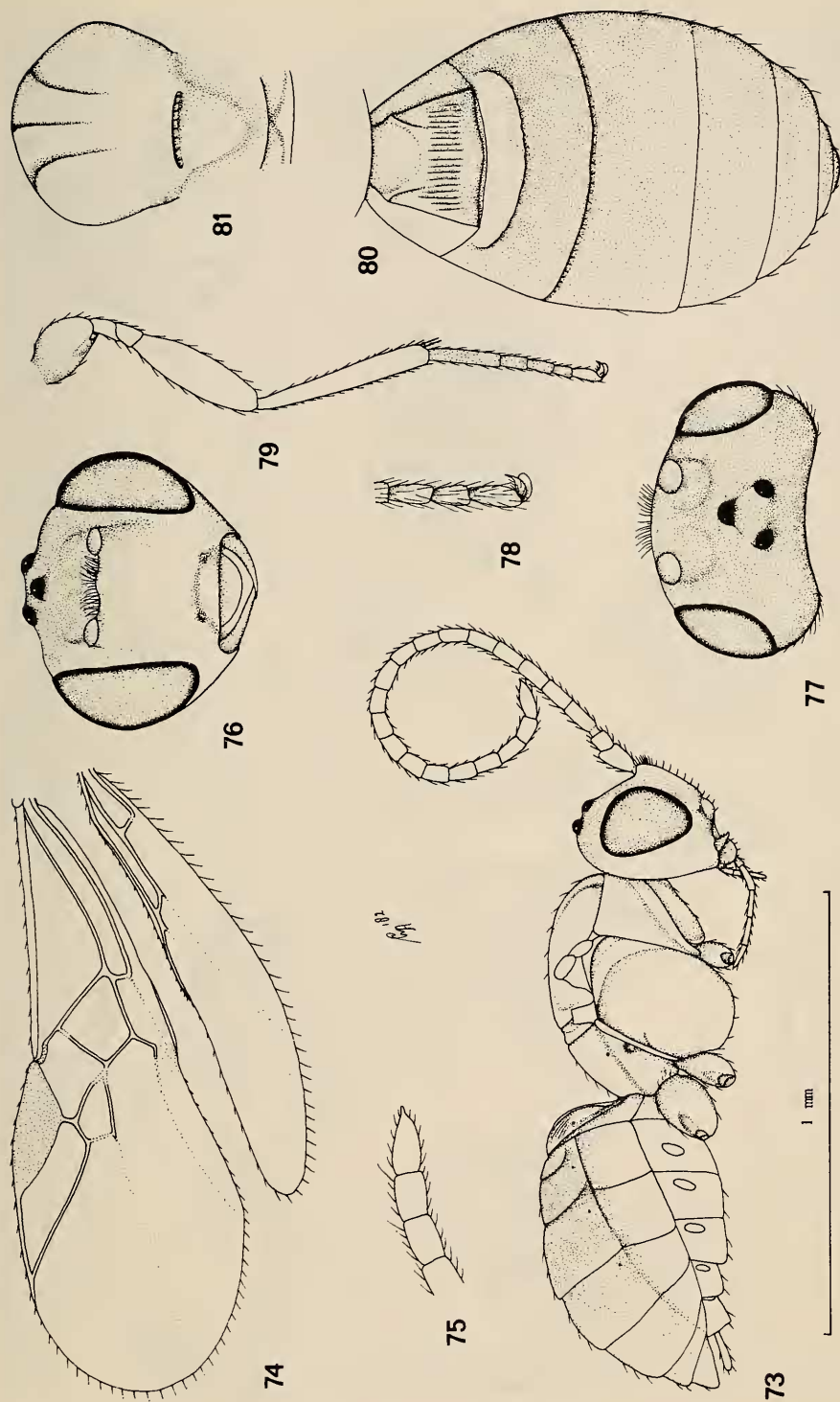
Figs. 44—54. *Gnaptodon georginae* spec. nov., holotype, ♂ (but 53 and 54 of ♀ paratype ex *Stigmella malella* (Stainton)). 44, habitus, lateral aspect; 45, head, frontal aspect; 46, wings; 47, hind claw; 48 and 54, apex of antenna; 49, thorax, dorsal aspect; 50, hind leg, dorsal aspect; 51 and 53, metasoma, dorsal aspect; 52, head, dorsal aspect. 44, 46, 50: scale-line, 1 ×; 45, 52: 1.8 ×; 47, 48, 54: 2 ×; 49, 51, 53: 1.2 ×.



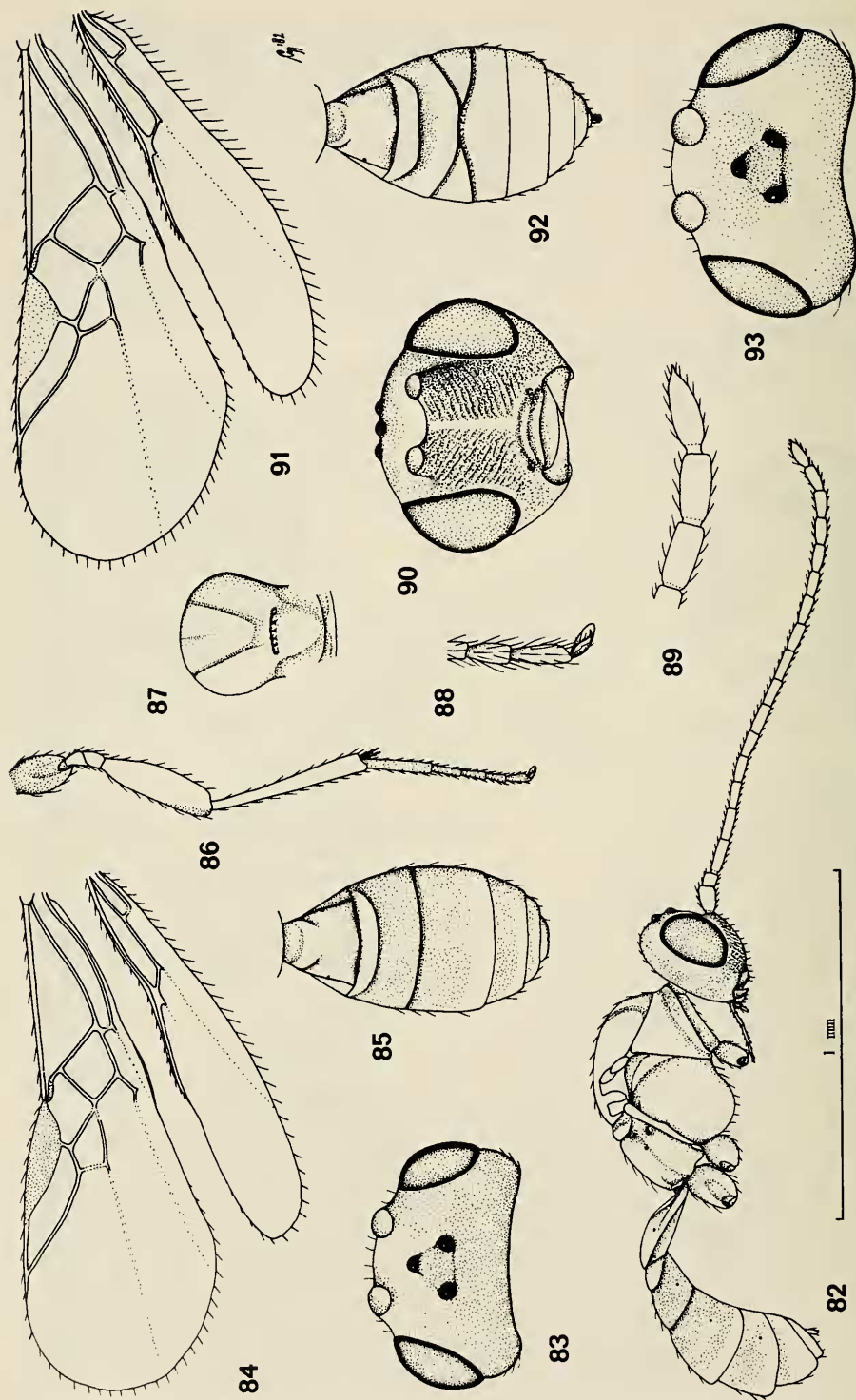
Figs. 55—63. *Gnaptodon brevis* spec. nov., holotype, ♀. 55, habitus, lateral aspect; 56, head, dorsal aspect; 57, wings; 58, hind leg; 59, hind claw; 60, thorax, dorsal aspect; 61, apex of antenna; 62, head, frontal aspect; 63, metasoma, dorsal aspect. 55, 57, 58: scale-line, 1 ×; 56, 60, 62, 63: 1.5 ×; 59, 61: 2 ×.



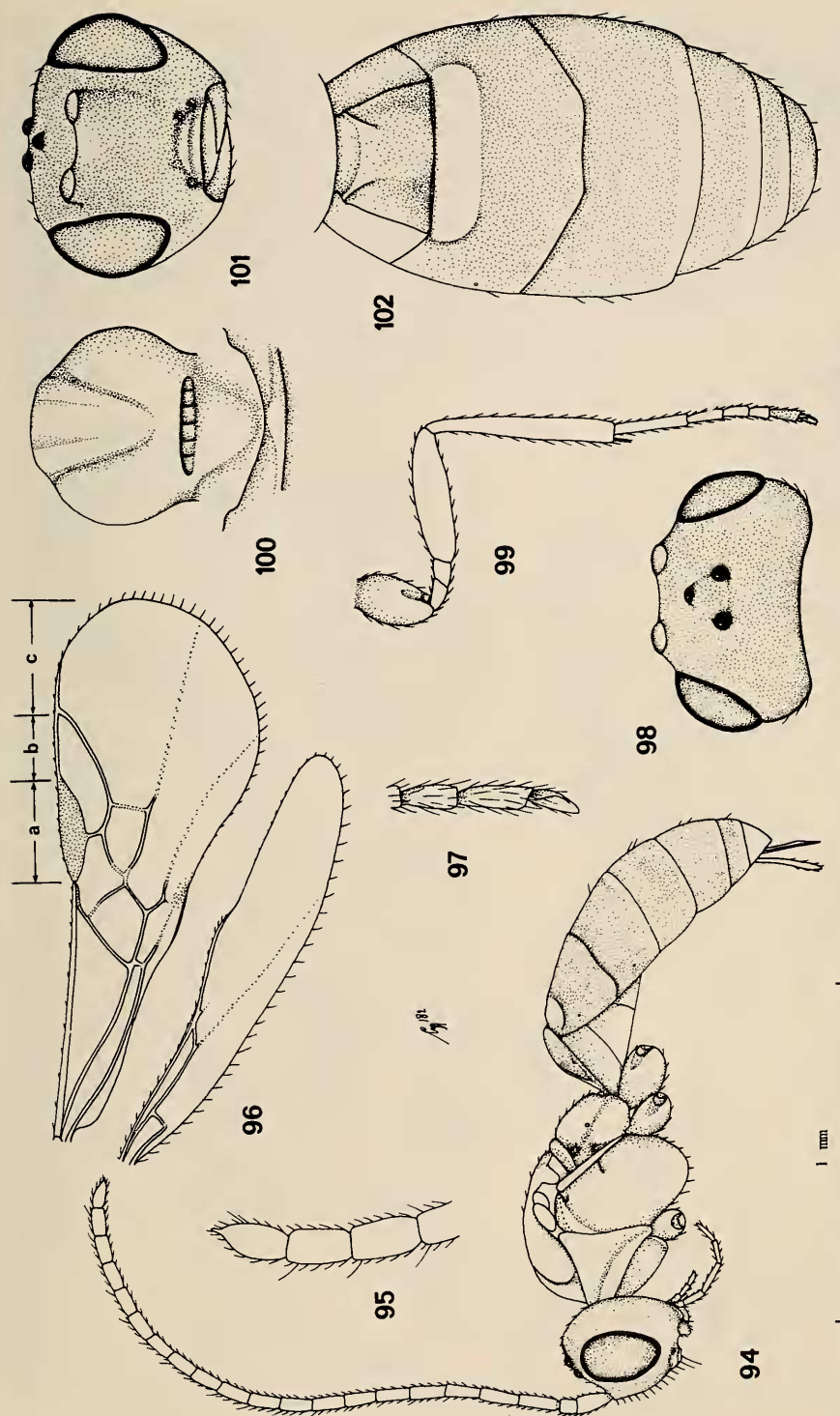
Figs. 64—72. *Gnaptodon vlugi* spec. nov., holotype, ♂. 64, habitus, lateral aspect; 65, wings; 66, apex of antenna; 67, hind claw; 68, head, frontal aspect; 69, thorax, dorsal aspect; 70, head, dorsal aspect; 71, scale-line, 1 ×; 66—69, 71, 72: 2 ×.



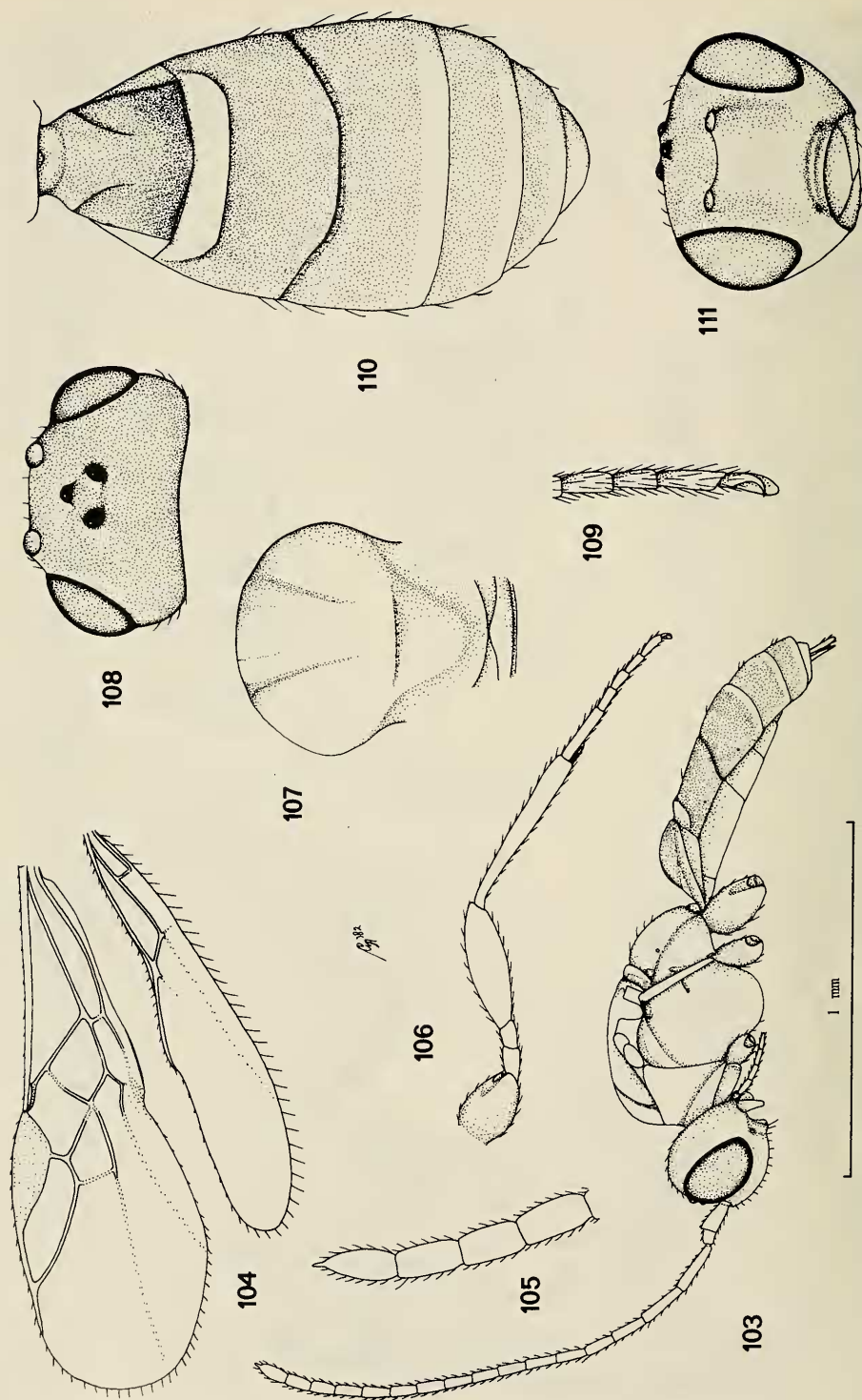
Figs. 73—81. *Gnaptodon pilosus* spec. nov., holotype, ♀. 73, habitus, lateral aspect; 74, wings, lateral aspect; 75, apex of antenna; 76, head, frontal aspect; 77, head, dorsal aspect; 78, hind leg; 79, hind leg; 80, metasoma, dorsal aspect; 81, thorax, dorsal aspect. 73, 74, 79: scale-line, 1 ×; 75, 78: 2 ×; 76, 77, 80, 81: 1.5 ×.



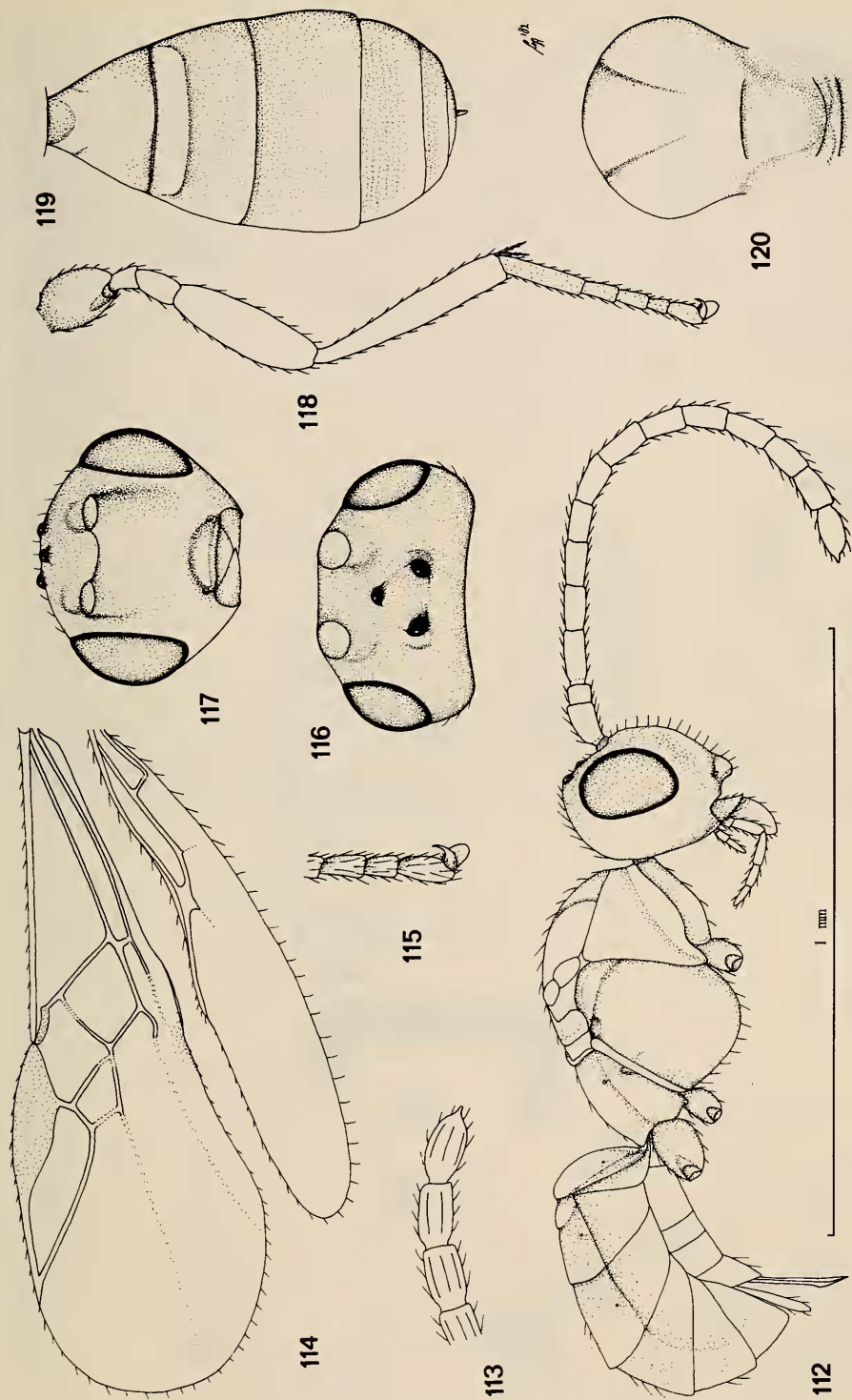
Figs. 82—90. *Gnaptodon nieuwerkerkeni* spec. nov., holotype, ♀. 82, habitus, dorsal aspect; 83, head, dorsal aspect; 84, wings; 85, metasoma, dorsal aspect; 86, hind leg; 87, thorax, dorsal aspect; 88, hind claw; 89, apex of antenna. Figs. 91—93. *Gnaptodon breviradialis* Fischer, holotype, ♀. 91, wings; 92, metasoma, dorsal aspect; 93, head, dorsal aspect. 82, 84—87, 91, 92 : scale-line, 1 ×; 88, 89: 2.5 ×; 83, 90, 93: 2.5 ×.



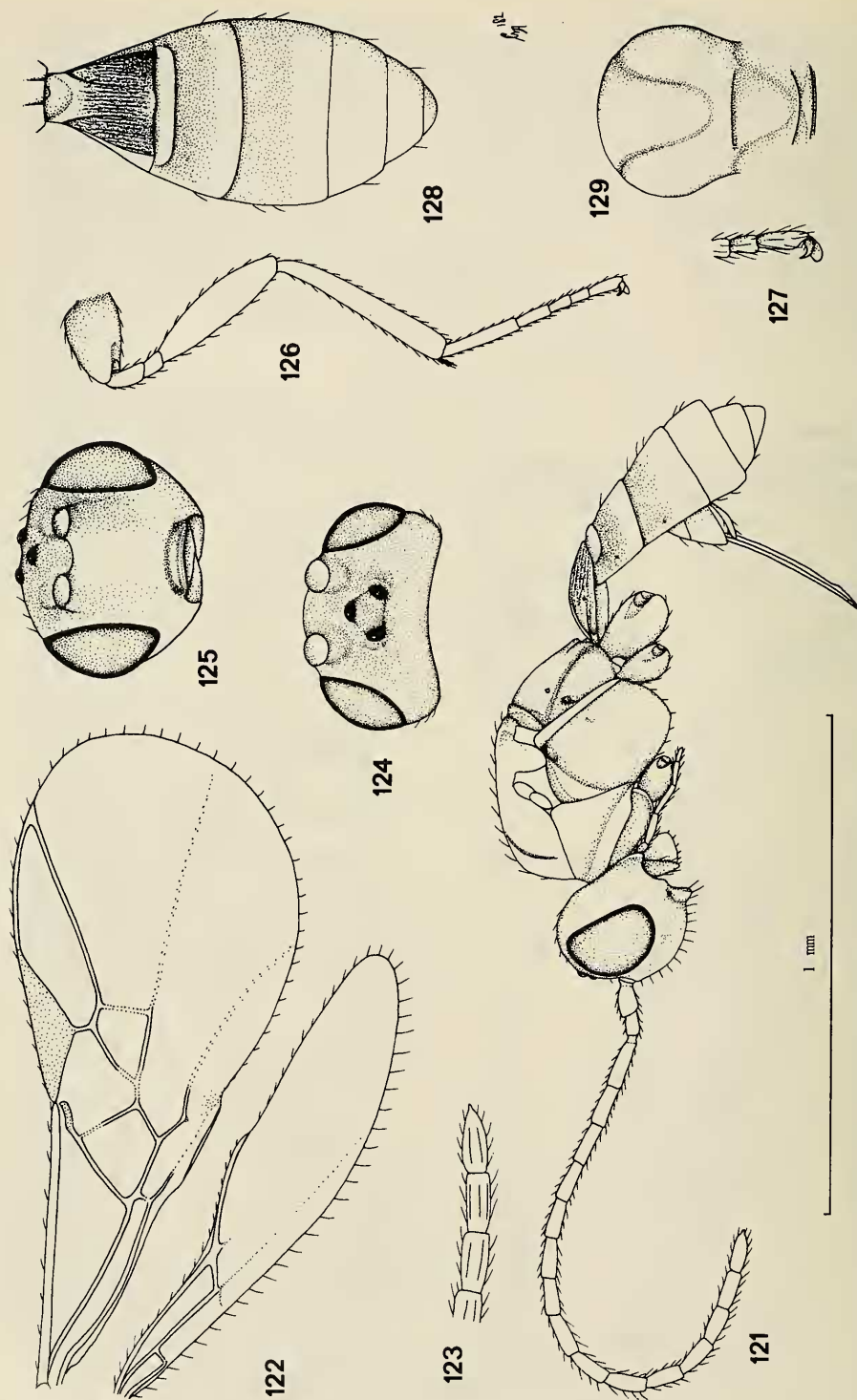
Figs. 94—102. *Gnaptodon ruficeps* spec. nov., holotype, ♀. 94, habitus, lateral aspect; 95, apex of antenna; 96, wings, *a*, length of pterostigma, *b*, length of 1-R1, *c*, distance between apex of fore wing and apex of marginal cell; 97, hind claw; 98, head, dorsal aspect; 99, hind leg; 100, thorax, dorsal aspect; 101, head, frontal aspect; 102, metasoma, dorsal aspect. 94, 96, 99: scale-line, 1 ×; 95, 97: 2.5 ×; 98, 100—102: 1.6 ×.



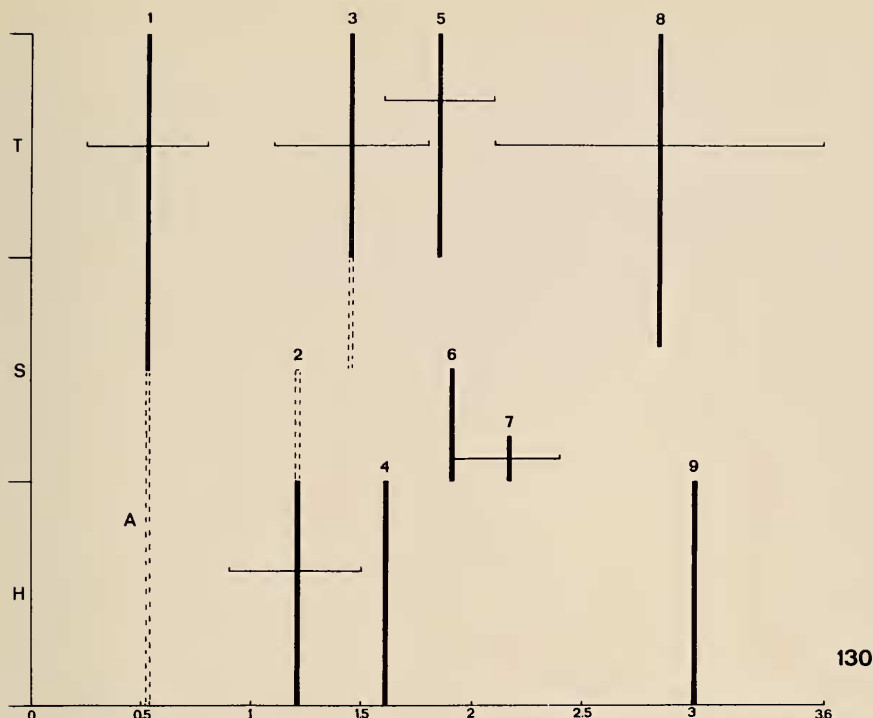
Figs. 103—111. *Gnaptodon erasmi* spec. nov., holotype, ♀. 103, habitus, lateral aspect; 104, wings; 105, hind leg; 106, apex of antenna; 107, thorax, dorsal aspect; 108, head, dorsal aspect; 109, hind claw; 110, metasoma, dorsal aspect; 111, head, frontal aspect. 103, 104, 106: scale-line, 1 ×; 105, 109: 2.5 ×; 107, 108, 110, 111: 1.6 ×.



Figs. 112—120. *Gnaptodon bini* spec. nov., holotype, ♀. 112, habitus, lateral aspect; 113, apex of antenna; 114, wings; 115, hind leg; 116, head, dorsal aspect; 117, head, frontal aspect; 118, hind leg; 119, metasoma, dorsal aspect; 120, thorax, dorsal aspect. 112, 114, 118: scale-line, 1 ×; 113, 115: 1.5 ×; 116, 117, 119, 120: 1.3 ×.

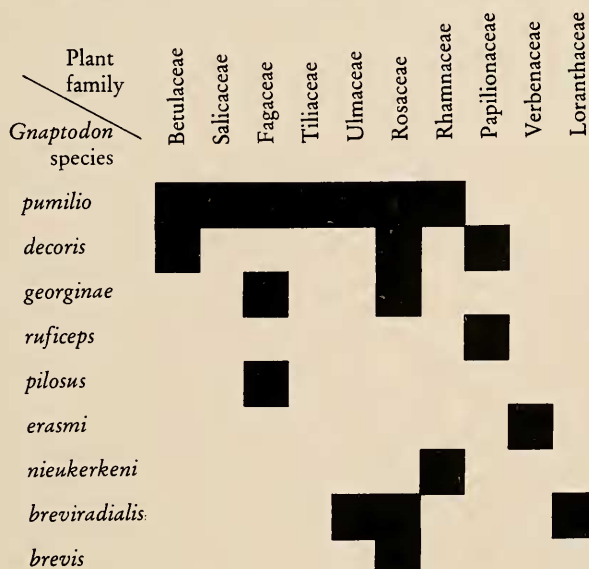


Figs. 121—129. *Gnaptodon similis* spec. nov., holotype, ♀. 121, habitus, lateral aspect; 122, wing; 123, apex of antenna; 124, head, dorsal aspect; 125, head, frontal aspect; 126, hind leg; 127, hind claw; 128, metasoma, dorsal aspect; 129, thorax, dorsal aspect. 121, 122, 126: scale-line, 1 ×; 123, 127: 1.6 ×; 124, 125, 128, 129: 1.2 ×.



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Fig. 130. Diagram depicting the vegetation zone wherein the host occur versus the indices of distance between the apex of the fore wing and the apex of the marginal cell ("c" in fig. 96) and length of vein 1-R1 ("b" in fig. 96). 1, *Gnaptodon pumilio* (Nees); A, form A; 2, *G. decoris* (Foerster); 3, *G. georginae* spec. nov. (in trees except *Quercus*); 4, *G. ruficeps* spec. nov.; 5, *G. pilosus* spec. nov. (in *Quercus*); 6, *G. erasmi* spec. nov.; 7, *G. nieuwerkerkeni* spec. nov.; 8, *G. breviradialis* Fischer; 9, *G. brevis* spec. nov.; T, tree zone; S, shrub zone; H, herb zone.



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Fig. 131. The occurrence of *Gnaptodon* species in plant families infested by Nepticulidae.